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AUTHOR Stern, Carolyn
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ABSTRACT

This bibliography, made up of approximately 350 entries concerned with many aspects of problem solving and concept formation in young children, has been designed for use by people primarily involved in experimental research in these areas of child development. Entries include experimental journal articles, conference papers, unpublished research papers, books (and specific book chapters), dissertations and literature reviews, which date from 1955 through 1968, and several earlier articles by Piaget. The wide variety of specific topics include: conservation studies and experimental research dealing with Piaget's theories; intelligence, achievement, memory and learning processes; socialization; learning theories; disadvantaged children and minority group differences; handicapped children; conceptual styles; verbal learning; cognitive development; discrimination learning; personality; research methodology; etc. (ED)

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PROBLEM SOLVING AND CONCEPT FORMATION: AN ANNOTATED BIBLIOGRAPHY

Carolyn Stern

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Achenbach, T. M. Cue-learning and problem-learning strategies in normal and retarded children. Paper presented at the biennial meeting of the Society for Research in Child Development, New York, March 1967.

> A cue-learning strategy (relying on situational cues) was contrasted with a strategy of relying on active attempts to educe abstract relationships among problem elements in a three-choice discrimination problem with retardates and normal children, mental age levels 7 1/2 and 10 years. As predicted, retardates took significantly longer than normals to give up reliance on a situational cue (a light presented along with the correct choice) and it was found that non-institutionalized retardates took significantly longer than institutionalized children. Hypothesizing a history of failure when relying on their own faculties as a reason for the increased reliance of retardates on situational cues, the authors devised a second experiment in which success or failure was educed prior to the learning task and in which a possible inhibiting effect of waiting for situational cues was tested. Results showed a significant inhibiting effect of waiting for a situational cue but no significant effect of the success-failure manipulation. However, pupils from a special class for retardates emphasizing successful experiences and self-reliance did significantly better on the task, giving up reliance on situational cues sooner than all other tested retardates and not significantly later than the normals.

Ackerman, W. I., & Levin, H. Effects of training in alternative solutions on subsequent problem solving. Journal of Educational Psychology, 1958, 49, 239-244.

> Two groups of sixth grade children were trained to solve 10 water jar problems. One group was given a single solution to the problem, the second was taught that problems were solvable by two alternative methods. On a succeeding set of problems, with solutions different from the two training solutions, the "alternative" group tended to solve more problems correctly, offered significantly more other-than-training solutions, and perservered longer on problems they were unable to solve. In a transfer test Ss were given 13 jigsaw puzzles: the first 8 all solvable by a single method so that a set might occur, the final 5 requiring various solution methods. Here, also, the Ss who were trained in alternative methods on the earlier water jar problems evidenced greater problem solving variability by using significantly more pieces of the puzzles not used in the training series than the no-alternative group.

Alberts, E., & Ehrenfreund, D. Transposition in children as a function of age. Journal of Experimental Psychology, 1951, 41, 30-38.

Forty-eight nursery school children 3 to 3.11 and 4.7 to 5.5 were trained to choose the smaller of two squares and then tested one, two, four and five steps removed from the original stimulus. It was found that (1) older children had a high level of transposition, (2) younger children dropped from high to low transposition score as the test stimuli varied further from the training stimuli, and (3) older children tended to verbalize responses to size as cue. There was direct functional relationship between mental age and the amount of transposition on stimuli five steps removed from the training pair.

Almy, M. Young children's thinking. New York: Teachers College Press, 1966.

This is the initial report of a longitudinal study of children's thinking processes in early childhood, with the ultimate aim of exploring the educational significance of children's ability to understand the principle of conservation. Two groups of kindergarten first- and second-grade children from one lower and one middle-class school in New York City were given a series of readiness and achievement tests, as well as several tasks designed to measure ability to conserve. The middle-class children tested had acquired conservation sooner than lower-class children of the same age, and middle-class children who had demonstrated conservation on three different tasks were mentally more mature than the others tested. The Stencil Design Test, described as a non-verbal test of logical thinking, showed, particularly for middle-class children, a rather consistent correspondence with conservation ability.

Amster, H., & Marasculilo, L. Effect of type of pretraining and variety of instances on children's concept learning. Journal of Experimental Child Psychology, 1965, 2, 192-204.

The effect of instructional set on pretraining performance and subsequent learning of the mathematical concepts of set-union and set-intersection was studied in children approximately 10 years old. Verbal pretraining was found to facilitate learning during pretraining, compared with aesthetic pretraining. However, in the subsequent concept learning task, for which the same materials were employed, the Ss who had aesthetic pretraining acquired the concepts more readily than those who had rote-learning instructions during pretraining. This difference due to pretraining was only statistically reliable among relatively low socioeconomic status (SES) Ss in the condition

that received a small variety of instances of the concept. The variety of instances presented during the concept learning task did not significantly affect concept acquisition per se, but generalization to new instances was significantly greater when the concept had been learned originally from a small rather than a large variety of instances.

Anderson, R. C. Can first graders learn an advanced problem-solving skill? *Journal of Educational Psychology*, 1965, *56*, 283-294.

A training procedure employing programmed instruction techniques was used to teach high IQ first-graders to solve problems by varying each factor in succession while holding all other factors constant. On training tasks presented again later to test retention, the trained group ($N=30$) solved more problems ($p < .01$) with fewer unnecessary trials ($p < .01$) than the control group ($N=30$). The trained group also solved more transfer problems ($p < .01$) and solved these more efficiently ($p < .01$) than did the control group. The results indicate, contrary to prominent developmental theories, that children can acquire, retain, and transfer rather complex and "advanced" problem-solving skills when presented with the suitable training.

Andersson, Bengt-Erik. (Concept learning and feedback with two types of material.) *Padagogisk Forskning*, 1965, *2*, 65-79.

The purpose of the experiment described in this report was to examine how acquisition and retention of learning material are affected by the placement of feedback during the exercise period. Two different learning materials were used. One of them represented the concept learning concerned with direct objects. The other represented a more mechanical type of learning dealing with calculating the area of rectangles. Each learning material consisted of a booklet containing 20 items, one on each page, and was preceded by a short lesson presenting the procedure. Feedback was given in two ways, either after each item (immediate feedback) or after the entire completed exercise (delayed feedback). The time for each item and the time for the feedback were constant. Retention was tested with two tests, each consisting of 10 items. One was given immediately after the exercise period, and the other 24 hours later. Ninety-two fourth-grade boys and girls were given both kinds of learning material. With both, immediate feedback showed considerable superiority over delayed feedback during the learning phase. The retention, on the other hand, showed no difference between the two conditions.

Angelino, H., & Shedd, C. L. An initial report of a validation study of the Davis-Eells tests of general intelligence or problem-solving ability. Journal of Psychology, 1955, 40, 35-38.

The Davis Eells Test was made up to control those cultural differences in children which affect intelligence scores on most existing tests. A total of 307 children, 152 of the lower socioeconomic class and 155 of the upper socioeconomic class, in the first six grades, was tested. All differences were statistically significant in favor of the economically favored group. The authors conclude that this test is still contaminated with cultural factors.

Annett, M. The classification of instances of four common class concepts by children and adults. British Journal of Educational Psychology, 1959, 29, 223-236.

Dispositional views of conceptual thinking suggest the need for a descriptive study of the ways in which normal subjects of various ages classify familiar objects. The sortings and explanations of 303 children, aged 5-11 years, and 42 adults, aged 18 to 73 years, in grouping pictures of common objects, were analyzed. The explanations were classified for both form and content. Five methods of explanation were distinguished, only two of which are recognized in logic. There were four main types of content, the most numerous at all ages being those concerned with spatial position and activity. The main developmental changes were found in method of explanation. Older adults perform more like children than younger adults.

Arnoff, M. The attainment of social studies concepts: The six year old. Paper presented at the annual meeting of the American Educational Research Association, Chicago, February 1966.

The consensus of learned opinion is that the social studies curriculum of the public school is no longer an effective instrument for the realization of currently appropriate educational goals. One major complaint is that the fact load of the social studies underestimates children's abilities, especially in the primary grades. It is also argued that children should not be insulated from studies of the world until the fourth year of school. Further curriculum development appears dependent upon assessment of the abilities of the 6-year-old to 1) develop concepts beyond those of first-grade social studies texts, and 2) learn selected concepts about a foreign culture. Teachers of first grade were identified as "social studies emphasizing" (SSE) and "non-social studies oriented" (NSS). Three classrooms were selected from each group. A "Practice-Test" ("Families"-Form A) was administered in December. These results were not analyzed. Form B was analyzed in January 1966. Form I of "Families in Japan" was administered in January 1966.

Atkinson, R. C., Hansen, D. N., & Bernbach, H. A. Short-term memory with young children. Psychonomic Science, 1964, 1, 255-256.

Two groups of children, one group composed of 4-year-olds, the other of 5-year-olds, were subjects in a short-term memory experiment specifically designed for young children. The results indicated that the technique was successful in permitting the collection of orderly data from these Ss.

Ausubel, D. P., & Schiff, H. M. The effect of incidental and experimentally induced experience in the learning of relevant and irrelevant causal relationships by children. Journal of Genetic Psychology, 1954, 84, 109-123.

With respect to the learning of a relevant and an irrelevant causal relationship in a teeter-totter problem by kindergarten, third grade, and sixth grade children, the following conclusions seem justified: The ability to learn a relevant causal sequence and to inhibit the learning of an irrelevant causal sequence increases with age. Despite the fact that children at all three age levels were able to utilize an irrelevant antecedent cue in learning to predict a consequence, they usually offered relevant explanations for their predictions.

Avery, G. E. A preliminary study of the participation of disadvantaged children in inquiry training. Fresno State College, California, 1966.

Two groups of fifth and sixth graders, one of which was disadvantaged, were given 12 weekly inquiry training sessions in a study to determine if disadvantaged children can profit from a discovery method approach when participating in a group with "nondisadvantaged" children. The disadvantaged group made significant gains as measured by the STEP Science Achievement Test, while the nondisadvantaged children and controls did not; but the nondisadvantaged children's pretest scores were higher than posttest scores of the disadvantaged children. Further investigation of the inquiry training approach to learning with disadvantaged children is underway.

Baldwin, A. L. How children learn. Childhood Education, September 1958.

The problem of insightful vs. non-insightful learning is discussed, as well as the effects of anxiety on learning. It is suggested that both insightful and non-insightful learning are desirable, depending upon the specific skills involved and the level at which they are being taught. It is further suggested that anxiety may improve performance if anxiety-reducing mechanisms which interfere with learning are eliminated. The argument is advanced that research in these areas supports the notion that toughening the educational process may be justified.

Balla, D., & Zigler, E. Discrimination and switching learning in normal, familial retarded, and organic retarded children. Journal of Abnormal and Social Psychology, 1964, 69, 664-669.

In an effort to explicate the contradictory findings of earlier studies, normals, familiar retardates, and organic retardates at two mental age levels were trained on either a three- or two-choice discrimination task. Following solution of the original task Ss were switched to either a new three-choice discrimination, a two-choice transposition, or a two-choice reversal problem. No significant effects on either the first or second problems are found. No support is provided for the view that the cognitive functioning of retardates is inherently different from normals of the same mental age.

Bardecki, A. Child's appreciation of relation of part and whole. (Psychological Abstracts, 1962, 36, 304.)

Replication of experiments carried out by Jean Piaget and Alina Szemska. The author believes that his experiments confirm their basic thesis that children age 3-7 are unable to think on an operational level.

Baumeister, A. A., Beedle, R., & Hawkins, W. F. Transposition in normals and retardates under varying conditions of training and test. American Journal of Mental Deficiency, 1964, 69, 432-437.

Forty institutionalized retarded adolescents, diagnosed as cultural-familial (mean CA=15.5, mean IQ=57.7), and 40 normal children (mean CA=7.68, mean IQ-109.8) matched roughly on mental age served as Ss. "Half the Ss in each intelligence group were conditioned to respond to the middle-sized and the remainder were trained to the largest of 3 blocks with an area ration of 2:1. The training blocks ranged in area from 1 sq. in. to 4 sq. in. Tests of transposition were conducted under 2 conditions: overlapping and non-overlapping. In the overlapping test the blocks included the 2 larger forms employed in original learning and a 3rd, 8 in. square. In the non-overlapping situation, a set of these blocks was used, all 3 of which were larger than those used in original learning. There were no differences between retardates and normals with respect to transposition. Nor were any differences in transposition attributable to the overlapping vs. non-overlapping variable."

Baumeister, A. A. Analysis of errors in the discrimination learning of normal and retarded children. Psychonomic Science, 1966, 6 (12), 515-516.

Normal and mentally retarded children were tested on a three choice size discrimination learning problem. Most of the normals and about half of the retardates were able to reach a criterion of five consecutive correct responses within 60 trials. An analysis of response patterns indicated that the nonlearners made a much higher proportion of perseverative errors than the learners. By contrast, the successful Ss were characterized by a pronounced tendency to commit alternation errors.

Beier, E. G., & Donoviel, S. J. Repeated exposure of subliminal stimuli to different age groups. Journal of General Psychology, 1963, 69, 181-186.

In a follow-up to a series of studies which led to a basic reappraisal of the concept of the "subliminal stimulus" it was found that cues relevant to solving a problem in a learning task evidently facilitate the solving of a problem, whether or not S is able to report the cues. When cues are introduced where the task is peripheral to the main activity of the S, relevant cues will not give help in problem solving. Other results of the series suggest confirmation that so-called subliminal cues become reportable with repeated exposure, that lower shutter speed increases early reportability, that words with greater redundancy (land-and) are more quickly reported, and that age does not appear to influence reportability.

Beilin, H. Perceptual-cognitive conflict in the development of an invariant area concept. Journal of Experimental Child Psychology, 1964, 1 (3), 208-226.

A hypothesized perceptual-cognitive conflict condition was used as an analogue in testing performance of children 5-11 years of age on Piaget's area conservation problem. Judgment of area equality in the "conflict" condition was more difficult for all ages than the "no-conflict" condition. Predicted utilization of infralogical strategies (iterative and translocational) in making the area equality judgments was confirmed. Employment of those infralogical methods was inversely related to the complexity of conflict patterns. Attainment of correct area equality decisions was on an all-or-none basis. The inability to utilize available cognitive resources in making equality judgments when patterns are not congruent is discussed.

Beilin, H. Learning and operational convergence in logical thought development. Journal of Experimental Child Psychology, 1965, 2, 317-339.

Kindergarten Ss (N=170) were tested, trained and retested on conservation tasks. Pre and posttesting were on length, number and area conservation using nonverbal reinforcement, verbal orientation-reinforcement, verbal rule instruction and "equilibration" methods. Results indicate training to be effective in facilitating conservation performance but principally with the verbal rule instruction method. No conservation learning transferred to the area task. Correct verbalization of the conservation principle, both before and after training, was less predictive of correct performance in conservation tasks than the reverse. On pretest, there was little convergence of conservation performance for children who did not fully conserve. Training materially increased convergence, but not to the extent represented among conservers who acquired the capacities less formally.

Beilin, H. Feedback and infralogical strategies in invariant area conceptualization. Journal of Experimental Child Psychology, 1966, 3, 267-278.

An attempt was made with 236 first and second grade Ss to improve performance in a quasiconservation task where a high rate of error was previously reported. Translocation, iteration, and feedback training methods were used. Only the feedback procedure proved effective. Feedback is interpreted as leading to the use of available infralogical (translocative and iterative) strategies on an all-or-none basis. Quasiconservation is identified as an example of static object invariance, and conservation as an example of dynamic object invariance.

Beilin, H., & Franklin, I. C. Logical operations in area and length measurement: Age and training effects. Child Development, 1962, 33, 607-618.

Piaget, Inhelder, and Szeminska's characterization of the development of length and area measurement was tested with first and third grade children. A delibrate attempt to influence measurement concept acquisition by instruction was also tested in a transfer of training experiment. It was found that length measurement is achieved prior to area measurement, contrary to the Piaget _et al_. description. For the first and third graders the achievement of measurement is affected by the test itself, and third graders are influenced further by instruction in measurement concepts. Piaget's developmental theory is given support by the evidence that no first grader achieves operational area measurement even with training and instruction.

Beller, E. K., Weber, W., & Amidon, E. Teacher behavior and intellectual functioning in deprived kindergarten children. Paper presented at the annual meeting of the American Educational Research Association, Chicago, 1966.

A study to test the hypothesis that indirect teaching behavior at kindergarten level enhances the intellectual functioning of deprived children was carried out with 79 children, 4 to 6½ years of age, 95 per cent Negro of extremely deprived lower class families. Teacher-pupil interaction and intellectual functioning of children were assessed. Children taught by teachers with an indirect method tended to perform higher on both verbal and non-verbal measures of intelligence.

Berlyne, D. E. Recent developments in Piaget's work. _British Journal of Educational Psychology_, 1957, _27_, 1-12.

A survey of Piaget's recent work on the development of children's psychological functions from birth to adolescence concentrates on the cognitive aspect of behavior, without neglecting affective factors. Selected bibliography of 18 titles in English and French dating from 1949.

Berlyne, D. E. _Conflict, Arousal and Curiosity_. New York: McGraw-Hill, 1960.

A review of literature and theoretical analysis of research in areas of exploratory behavior, novelty, attention and conflict. Findings are discussed in terms of a modified drive-reduction learning theory, and neurophysiological data are involved throughout. Implications for the psychology of knowledge and thinking, and for art and humor are noted. Includes a name and subject index, 602-item bibliography.

Berman, P. W., & Graham, F. K. Children's response to relative, absolute and position cues in a two-trial size discrimination. _Journal of Comparative and Physiological Psychology_, 1964, _57_, 393-397.

Ninety-six 2-year-olds and 96 4-year-olds were used to test the capacity of relative size to serve as a stimulus where only one generalization gradient could be operating. The effects of a single forced reward or nonreward on the distribution of second-trial choices in a 2-pair size discrimination were determined. By manipulating the size and position of 3-stimuli, choice of position, absolute size, and relative size could be evaluated independently. Only response to relative size showed significant effects of age and differential effects of reinforcement. Reward produced a significant increase in same relative size choices. Younger children perseverated and older children shifted choices after nonreward.

Bingham, A. Problem-solving in all areas of learning. Childhood Education, December, 1958.

The importance of problem-solving abilities in everyday life are discussed, and a problem is defined as "a hindrance that blocks an individual's presently constituted powers to achieve a desired goal." Essential elements of a problem are suggested and some components of the problem-solving process are listed. Suggestions are given for orienting classroom experiences of children toward the development of problem-solving skills.

Birch, H. G., & Belmont, L. Auditory-visual integration, intelligence and reading ability in school children. Perceptual and Motor Skills, 1965, 20, 295-305.

A total of 220 elementary school children participated in a developmental study of auditory-visual equivalence. It was found that improvement in auditory-visual integration was most rapid in the earliest school years and reached asymptote by the fifth grade. The correlations obtained between IQ and auditory-visual integration suggested the possibility that in acquiring reading skill primary perceptual factors are most important for initial acquisition, but more general intellectual factors for later elaboration.

Birch, H. G., & Bortner, M. Stimulus competition and category usage in normal children. Journal of Genetic Psychology, 1966, 109 (No. 2), 195-204.

The object-matching behavior of 188 normal children, 3-10 years of age, was studied with the index object presented among 3 objects from which a matching choice had to be made in terms of function and class membership, with either similar or non-similar stimulus features. It was found that when stimulus similarities were available for choice, young children preferentially matched for these. When such stimulus competition was eliminated, many children exhibited the possession of previously unexpressed concepts of class and functional relatedness. The results are considered in relation to the problem of concept possession as contrasted with concept availability in normal and brain-damaged persons.

Boger, J. H. An experimental study of the effects of perceptual training on group IQ scores of elementary pupils in rural ungraded schools. Journal of Educational Research, 1952, 46, 43-53.

Twenty-five rural white and 29 Negro children in grades 1-4 were provided with stimulating visual materials involving reasoning ability of a perceptual nature in a study to determine whether such training would enhance performance on subsequent intelligence tests. The children, each group in an intact rural classroom under a single teacher, were given the Otis Quick Scoring Mental Ability Test and the California Test of Mental Maturity before the 5-month training period. Training provided practice in noting details, perceiving spatial relationships, detecting likeness and difference in pictorial and geometric patterns, and developing coordination of eye-hand movements. Both Negro and white children showed significant increases in total IQ's and California non-language scores after training, as well as on Spatial Relationships and Logical Reasoning scores subtests of the California test. Gains were maintained 5 months after the training period.

Bowes, A. E. Problem difficulty as a factor in learning set formation by children. Dissertation Abstracts, 1963, 23, 4752.

Sixteen boys and girls of average or higher intelligence, grades 1-3, were given a series of problems using Munsell color standards as stimuli in a study to contrast multiple problem learning, or learning set, with single problem learning. Problem difficulty was varied by using similar or dissimilar stimuli. Two groups got problems at one level (hard or easy) only, and two groups switched levels after six problems. It was expected (1) that Ss would show slower inter- and intra-problem learning of difficult problems, (2) that positive transfer would be found for groups switching conditions, (3) that switching from hard to easy would facilitate learning set formation, and (4) that switching from easy to hard would result in increased errors immediately following the switch, but would result in over-all positive transfer compared with the group given only difficult problems. Results confirmed the hypotheses, with problem difficulty proving an important variable in learning set formation.

Braine, L. G. Age changes in the mode of perceiving geometric forms. *Psychonomic Science*, 1965, *2*, 155-156.

> This experiment provides evidence that the order in which parts of a form are scanned changes in the preschool period. Geometric forms were constructed to have focal and distinguishing features, and the forms were presented tachistoscopically in two orientations. Recognition was enhanced in 3-year-old Ss when the form was oriented with the focal part at the top and the distinguishing feature at the bottom, whereas Ss about 5 years old recognized the forms better when the distinguishing feature appeared at the top.

Braine, M. D. S. The ontogeny of certain logical operations: Piaget's formulation examined by nonverbal methods. *Psychological Monographs*, 1959, *73* (Whole No. 475), 43p.

> Children 3.6 to 7.0 years of age from two day-nurseries in New York City served as Ss in an investigation of Piaget's theory of the development of intellect. The development of logical inferences and the concepts of position order were studied under different experimental treatments.

Braine, M. D. S. Development of a grasp of transitivity of length: A reply to Smedslund. *Child Development*, 1964, *35*, 799-810.

> A critical reaction to Smedslund's recent report of an 8-year emergence of transitivity of length is based on evidence indicating that the task requirements were probably not clear to Smedslund's Ss, and that his data are consistent with an earlier age of emergence. Second, Smedslund's contention that simple generalization processes account for the writer's finding of length transivitity in most 5-year-olds is disputed by a control experiment reported. Smedslund's own data on the point seem irrelevant. Further, it is argued that the kind of experimental procedures advocated by the writer yield better support for Piaget's concept of developmental stages than "classical" Piagetian procedures.

Braine, M. D. S., & Shanks, B. L. The conservation of a shape property and a proposal about the origin of the conservations. *Canadian Journal of Psychology*, 1965, *19*, 197-207.

> The development of a grasp of the distinction between real and phenomenal shape is explored in an experiment in which refraction in water is used to make bent rods look straight and straight rods look bent. Responses were required to the questions,

"Which looks bent?" and "Which is really bent?" Results showed that most children are capable of distinguishing real and phenomenal shape by about 5 years of age. The age trends found are the same as those previously found in 3 size conservation experiments. It is suggested that his concordance in results is due to the development of a quite general distinction between real and phenomenal properties of objects, and that this distinction is the basis of the conservations. This proposal is elaborated; it differs from Piaget's views in implying that the conservation of non-quantifiable attributes (e.g., shape) exists and has the same basis as the conservation of quantifiable attributes.

Brison, D. W. Acceleration of conservation of substance. Journal of Genetic Psychology, 1966, 109, 311-322.

Twenty-four nonconserving Ss received experimental training designed to induce conservation of substance. Twenty-six matched control Ss were not trained. Training was in the conservation of inequalities of liquid in a situation where the S's expectation of an event was reversed. Twelve of the experimental Ss showed evidence of acquiring conservation. Five of these Ss gave at least four of five correct conservation predictions. The five experimental Ss with four correct predictions performed similarly to Ss possessing conservation before the experiment on an extinction item.

Brown, B. R., & Deutsch, M. Some effects of social class and race on children's language and intellectual abilities, a new look at an old problem. Paper presented at the biennial meeting of the Society for Research in Child Development, Minneapolis, March 1965.

Two-hundred ninety-two New York children, grades 1 and 5, from low SES neighborhoods, were studied to determine whether intraclass variance can be accounted for more precisely by identifying the relevant factors that may operate to either enhance or inhibit the development of specific cognitive abilities. Six social variables, each of which correlated significantly with reading level scores, were combined to form an index of relative deprivation. The vocabulary subtest of the WISC, the Lorge-Thorndike Intelligence Test, the Peabody Picture Vocabulary Test and the Gates Paragraph Reading Test were used to measure specific levels of cognitive performance; and these scores were examined statistically in relation to data on SES, race, and relation deprivation. Results demonstrated that intraclass variance can be accounted for more precisely than has been done in the past, and that within a socio-economic status group particular levels of cognitive performance reflect certain specific environmental characteristics.

Bruner, J. S. The cognitive consequences of sensory deprivation. In P. Solomon (Ed.), Sensory Deprivation. Cambridge: Harvard University Press, 1961, Pp. 195-207.

> To operate effectively in an environment an organism must develop a model of the environment as a means of conserving information in concepts or universals, and to enable it to perform the kind of inference which goes beyond the information given. This kind of learning develops gradually and organizes rules that conserve and represent the redundant structure of the environment. A rich sensory environment permits the development of differentiation of spheres of activity, sensory modalities, and events within modalities. Sensory deprivation prevents such development. Early sensory deprivation prevents formation of adequate models and strategies for dealing with the environment, and later sensory deprivation in normal adults disrupts the vital evaluation process by which one constantly monitors and corrects the models and strategies one has learned to employ in dealing with the environment.

Bruner, J. S. The course of cognitive growth. American Psychologist, 1964, 19, 1-15.

> Development of human intellectual functioning from infancy to maturity depends upon the mastery of techniques and cannot be understood without reference to such mastery. These techniques are not, in the main, inventions of the individuals who are growing up; they are, rather, skills transmitted with varying efficiency and success by the culture--language being a prime example. Cognitive growth, then, is in a major way the growth of symbolic functioning.

Bussis, A. M., & Melton, R. S. Piaget for first grade teachers: A guide for understanding intellectual development. Paper presented at the annual meeting of the American Educational Research Association, Chicago, February 1966.

> Items significant for cognitive development of first-grade children were chosen to indicate development at the Piagetian level of logical concrete functioning. Concepts of space and time, growth of logical reasoning, understanding mathematics, oral communication, learning about the world, and imagination and creativity were reorganized into the following six areas: basic language skills, concepts of space and time, beginning logical concepts, beginning mathematical concepts, the growth of reasoning skills, and general signs of development, after the first year's tryout in a sample of 25 New York City schools.

Butts, D. P. The evaluation of problem solving in science. Journal of Research in Science Teaching, 1964, 2, 116-122.

> A test for problem solving at the fifth- and sixth-grade levels of science instruction is described. Types of problem solving behavior measured included early formation of a hypothesis, specific experimentation with relevant variables vs. random guessing, introduction of control to test validity of hypothesis, and specific attempts at verification of hypothesis. The test also requires the child to classify information as relevant, extra but useful, duplicate, or irrelevant.

Cantor, G. N. Effects of three types of pretraining on discrimination learning in preschool children. Journal of Experimental Psychology, 1955, 49, 339-342.

> Three groups, each consisting of 20 children, aged 3-5, were given identical treatment in a transfer task situation after having training with or without relevant labels. Results supported the prediction that possession of names for stimuli in learning a task enhances performance.

Cantor, G. N. The roles of attention in cognitive development familiarization effects and attention. Paper presented at the biennial meeting of the Society for Research in Child Development, New York, March 1967.

> Several studies involving the stimulus familiarization effect (SFE) and the change effect (CE) are discussed. SFE refers to the finding that a child's response speed is faster to non-familiar than to familiar stimuli, and CE refers to the finding that response speeds tend to be faster on a series of "change" trials alternating between familiar and non-familiar stimuli than on non-change trials (all familiar or all non-familiar stimuli.) Whether the SFE and CE are obtained seems to depend on the particular kind of motor task utilized and the particular response measure used. Several possible explanations for these effects are discussed, including a heightened state of "arousal," associative interference, and the cumulative development of strong attentional or orienting responses. The latter is suggested by the author to account for the relative durability of the effects. It is suggested that we are far from understanding the mechanism of, in particular, the CE.

Cantor, J. H., & Cantor, G. N. Functions relating children's observing behavior to amount and recency of stimulus familiarization. Journal of Experimental Psychology, 1966, 72 (6), 859-863.

> Subsets of 18 stimuli were presented to 108 kindergarten children and successively repeated so that the effects of amount

of stimulus familiarity could be studied within phases. Following five sessions for familiarization, all Ss received test phases after 5-minute, 2-day, and 7-day intervals. Although the overall means for the test phases differed significantly, no interaction was found between time interval and amount of familiarity.

Carey, J. E., & Goss, A. E. The role of mediating verbal responses in the conceptual sorting behavior of children. Journal of Genetic Psychology, 1957, 90, 69-74.

Forty preschool age children were divided into four groups of 10 Ss each. Eight blocks representing combinations of tall, short, large, small, circular, and square were presented one at a time in the window of a box-like exposure device. The experimental hypothesis of positive transfer from verbal learning to learning to sort was partially confirmed.

Carpenter, F. Educational significance of studies on the relationship between rigidity and problem-solving. III. The learning approach. Science Education, 1956, 40, 296-311.

A number of studies of various types of rigidity in problem-solving are reviewed, and the results discussed in terms of the implications for education. "Einstellung" behavior, the blinding effect presumably due to strong habits which stand in the way of elicitation of more successful modes of response, is discussed, as well as simple and repetitive perseveration, and other "rigid" behavior. Attention is paid to personal characteristics and training methods which seem to be associated with rigidity, and to factors which combat ridigity, such as distributed rather than massed practice, non-timed rather than time tasks, and low ego involvement on the part of the learner. Some implications for classroom use included the desirability of a non-authoritarian classroom atmosphere, allowing sufficient time for the learning of difficult material, rewarding a variety of responses and teaching to inhibit habitual responses.

Carpenter, F. Effect of different learning methods on concept formation. Science Education, 1956, 40, 282-285.

The Hanfmann-Kasanin or Vigotsky Block Test was used to test the hypothesis that learning of concepts is facilitated under meaningful compared to rote procedures. In condition I (meaningful) Ss were presented with randomly placed stimuli in normal positions on a flat surface and were asked to select members of a class. In condition II (rote) the experimenter presented the same stimuli and dominated Ss' attention by a continual line of verbal instruction. A posttest, given after one week, asked Ss to pick out certain stimuli under a two-minute time limit. Functional or meaningful learning of concepts was found to be more efficient than rote learning when measured by retention and ability to verbalize meanings of learned concepts. Concepts referring to classes of material objects were better understood when S manipulated and studied objects.

Chase, C. I. An application of levels of concept formation to measurement of vocabulary. Journal of Educational Research, 1961, 55, 75-78.

Twenty-six fifth-graders were asked to choose from four definitions of each of a list of 25 arithmetic vocabulary words. The definitions provided were a concrete example, a description of functional usage, an abstract of conceptual definition, and an incorrect distractor. It was concluded that there is a preference for definitions at levels of concept formation corresponding to progress in development of a concept. A three-level approach to measurement of concepts in arithmetic and other subjects is suggested.

Clapp, W. F., & Eichorn, D. H. Some determinants of perceptual investigatory responses in children. Journal of Experimental Child Psychology, 1965, 2, 371-388.

In contrast to the generally positive results from identical experiments with adults obtained separately by Berlyne and Minton, redundancy (i.e., relative uncertainty) showed no significant influence on responsiveness in three experiments with 24 nursery school children, using both geometric and meaningful stimuli.

Cobb, N. J., & Price, L. E. Reversal and nonreversal shift learning in children as a function of two types of pretraining. Psychological Reports, 1966, 19 (3-Part 1), 1003-1010.

Nursery school children were given pre-training with verbal labels for either one or two of the stimulus dimensions in the discrimination tasks prior to learning either a reversal shift, a nonreversal shift, or a control shift. Pretraining was found to have no measurable effect on later shift learning, nor on the ease of learning the three types of shift. Comparisons were made with the results of other studies which also indicated a failure of young children to use available labels as mediators of their choice behavior.

Corah, N. L. Color and form in children's perceptual behavior. Perceptual and Motor Skills, 1964, 18, 313-316.

Eighty preschool children and 80 older children matched perceptual stimuli by either color or form. Results supported earlier studies in that age differences were highly significant (younger children match on the basis of color) while there were no sex differences. These results were considered in relation to Piaget's concepts of concentration and decentration.

Corah, N. L., & Gospodinoff, E. J. Color-form and whole-part perception in children. Child Development, 1966, 37, (4), 837-842.

Forty preschoolers and 40 third-graders and 30 adult Ss were presented color-form and whole-part tasks in a developmental study. Young children gave more color and part matches than did older children. Under brief exposure, adults also gave more color and part matches than did control adults. Color and part matching were significantly related. The results were consistent with the theoretical position that centration effects underlie both color and part matching.

Corah, N. L., Jones, S. A., & Miller, B. B. The relation of verbal intelligence and color form discriminative ability to children's color-matching and form-matching behavior. The Journal of Psychology, 1966, 62, 221-228.

A group of 24 preschool "color responders" and a group of 24 preschool "form responders" were given tests of intelligence, color-discrimination, and form-discrimination. No significant differences between groups were found on these measures. A replication with two groups of 24 kindergarten children demonstrated that form responders discriminated color with significantly greater accuracy than color responders. Intelligence and color-form response were also assessed in a group of 40 third-graders. Again IQ was related to form matching, but the relationship fell short of statistical significance. The author postulates that color response can be considered as either a centration effect or a learned preference.

Corman, B. R. Learning: II. Problem solving and related topics. Review of Educational Research, 1958, 28, 459-467.

A review of recent research reflecting the rising interest in human problem solving. The need for more direct classroom tests of theoretical models was pointed up (91 references).

Covington, M. V. Some effects of stimulus familiarization on discrimination. Unpublished doctoral dissertation, University of California, Los Angeles, 1962.

> Seventy-two children just entering kindergarten were divided into groups of high and low status (based on parents' education) and tested on perception of abstract forms before and after training with the forms. Both groups improved their scores on the perception measure after training with control groups showing little gain, but the low-status group improved significantly more than the high-status group. Since the two groups' scores were not significantly different on posttest, it was suggested that the high-status group was near maximal performance prior to the treatment.

Coxford, A. F., Jr. The effects of instruction on the stage placement of children in Piaget's seriation experiments. Arithmetic Teacher, 1964, 11, 4-9.

> A study to replicate Piaget's work on understanding of numbers in children, and to investigate the effect of instruction on level of understanding of numbers matched Ss 21 to 89 months in pairs, one experimental and one control. Identical pre- and posttests were given, with a four-week instructional period of 15 minutes per day for the experimental Ss. Results showed children with no understanding of numbers were not significantly affected by instruction, but Ss in transitional stages showed significant improvement.

Cronin, V. S. Comparison of three methods of mirror-image reversal discrimination with kindergarten and first-grade children. Dissertation Abstracts, 1966, 27(4), 1279B.

> A total of 144 kindergarten and 72 first-grade children particpated in this study of three methods of mirror image discrimination. Methods of presentation were: (1) same-difference judgment for two triangles presented as a pair; (2) choosing the different triangle from a triad; and (3) choosing from a pair to match a sample. Some groups were corrected on all trials, while other groups never were, and some groups received trials in a reversed order to correct for possible order effects. Method 1, but not 2 and 3, showed significant differences between corrected and uncorrected subjects. Under conditions of corrections there were no significant differences between the methods. Older children performed significantly better than younger ones, and boys better than girls. More errors were made with upside down triangles (horizontal line on top) and matching was more difficult on items with a different figure separating the two which were the same.

Cross, H. A., & Tyer, Z. E. The overlearning reversal effect in preschool children as a function of age. Psychonomic Science, 1966, 6 (4), 175-176.

> It was hypothesized that the difference between animal and human reversal learning was related to the greater perceptual experience of the primates rather than phylogenetic level. Two age groups of preschool children were given a reversal either after criterion or overlearning. As predicted, overlearning produced effects with younger children but not older ones.

Cross, K. P., & Gaier, E. L. Technique in problem-solving as a predictor of educational achievement. Journal of Educational Psychology, 1955, 46, 193-206.

> One the basis of results obtained with the Balance Problems Test, a device which shows how an individual selects and makes use of principles as opposed to factual information in problem solving, the authors conclude that the techniques used in problem-solving are variables which can serve as differential predictors of school achievement. The tab format of the test is recommended since it provides a situation in which the subject is able to select the kinds and amount of information he believes will best enable him to solve the problems.

Davidon, R. S. The effects of symbols, shift, and manipulation upon the number of concepts attained. Journal of Experimental Psychology, 1952, 44, 77-79.

> Drawings and words representing four levels of abstraction were used for the same group of familiar objects to determine the effect of symbolic representation on efficiency of concept learning. Findings demonstrated that the less specific the symbol, the greater the number of concepts generated.

Davidon, R. S., & Longo, N. Conceptual development reflected in age differences in associations to names and pictures of objects. Journal of Genetic Psychology, 1960, 96, 85-92.

> For bright Ss at three age levels (10, 14, and 18-21 years) free associations to names and pictures of common objects were timed and recorded. Association times decreased with age. Free associations to pictures tended to be more rapid than those to spoken names of the corresponding objects, especially for the 10-year-olds. Heterogeneity of response was as great for the youngest as for the oldest Ss, and

repetition did not decrease consistently with age. As the superior child grows older there is a greater improvement in relating and verbally responding to names than to corresponding pictures.

Davis, G. A. Current status of research and theory in human problem solving. Psychological Bulletin, 1967, 66 (1), 36-54.

Problem solving theories in three areas are summarized: traditional learning, cognitive Gestalt approaches, and more recent computer and mathematical models of problem solving. Recent empirical studies are categorized according to the type of behavior elicited by the particular problem-solving task. Anagram, "insight," water-jar, and arithmetic problems are considered to be solved by covert trial-and-error behavior (Type C problem-solving tasks). Switch-light, classification, probability learning, and numerous "miscellaneous" tasks are approached by overt trial-and-error behavior (Type O problem solving tasks).

Davis, J. K. Mediated generalization and interference across five grade levels. Psychonomic Science, 1966, 6 (6), 273-274.

No effects of grade were found in a study of paired associate learning, under three treatment conditions--mediation, interference, and control at second, fourth, sixth, eighth, and college grade levels. No interaction effects were found, although all grade levels performed best on the mediation pairs, intermediate on the control pairs, and poorest on the interference pairs, with the exception of a slight reversal between control and mediation pairs for 8th graders.

Dienes, Z. P. The growth of mathematical concepts in children through experience. Educational Research, 1959, 2, 9-28.

Mathematics can be introduced to a larger section of the child population than has hitherto been thought practicable. This is done by coordinating the teacher's work with the natural process of concept formation in the child. Most children can understand complex workings of the four rules of arithmetic in the decimal and other systems. Normal 10-year-olds can learn solution of linear and quadratic equations if one uses a constructive point of view.

Dietze, D. Facilitating effect of words on discrimination and generalization. Journal of Experimental Psychology, 1955, 50, 255-260.

A total of preschool children 54-67 months old learned one of two sets of labels for objects. One set was similar (beem-meem) and the other distinctive (jod-daf). It was hypothesized that complex discrimination between similar objects would be easier if names applied to the forms were distinctive. Learning was measured in terms of (1) initial discrimination, (2) subsequent discrimination of related objects, (3) generalization to related objects, and (4) general efficiency of concept formation. The distinctive labels were learned significantly faster than the similar ones, and on each learning measure the different-names group learned faster than the similar-names group.

DiVesta, F. J. Developmental patterns in the use of modifiers as modes of conceptualization. Child Development, 1965, 36, 185-213.

A restricted word-association task, requiring S to respond with a single modifier for each of 100 substantives, was used to elicit modifiers from 100 Ss in each of grades 2-6. A list of modifiers, for applications in semantic differential scales, was selected according to the criteria of frequency of occurrence, diversity of usage, and independence from other modifiers. Modifiers having higher values on the frequency-diversity index were those representing the evaluative and potency dimensions, followed by those representing the color and activity dimensions. Developmental trends in the characteristics of modifiers and substantives showed differences in the manner in which substantives were qualified, with essential agreement in the use of modifiers across grade levels.

Dodwell, P. C. Children's understanding of number and related concepts. Canadian Journal of Psychology, 1960, 14, 191-205.

The number concepts of 5-8 year old children were studied by administering five tasks similar to Piaget's to 250 children in kindergarten and grades 1 and 2. Older children gave relatively more "concrete" operational responses, and younger ones were more likely to give "global" judgments; but, a child's type of response varied from one test situation to another, and there was little evidence of a consistent progression through Piaget's stages.

Dodwell, P. C. Relations between the understanding of the logic of classes and of cardinal number in children. Canadian Journal of Psychology, 1962, 16, 152-160.

In an experimental study of categorization with children 5-8 years of age, three types of replies were found corresponding to Piaget's three stages in number concept development: global comparison, operational judgment, and intuitive judgment, respectively. These findings throw some doubt on the Piaget postulations.

Dodwell, P. C. Children's understanding of spatial concepts. Canadian Journal of Psychology, 1963, 17 (1), 141-161.

In another test of Piaget theory, seven groups of test items relevant to different spatial concepts were individually administered to 194 school children, ages 5-11 years. The author found no basis for assigning any child to a particular stage of development. The ability to deal correctly with spatial concepts improved with age, but there seemed to be no clear progression from one type of thinking about space to another.

Droz, R., & Potter, T. F. Efficiency and strategy in search and exploration behavior and their modification with age and task repetition. Paper presented at the biennial meeting of the Society for Research in Child Development, New York, March 1967.

Searching and exploring behavior of adults and children was studied by having subjects trace over a sheet of paper fixed to a clipboard with a hole in it until the pencil found the hole. Search is defined as the activity of the organism directed toward the exposure of a more or less defined object to be found in a given field while exploration is the activity of an organism directed toward the exposure of a diffuse or not defined object which may or may not be found within a given field. "Search" subjects were instructed to find the hole as quickly as possible, "exploration" subjects were given a board with no holes on 4 out of 6 trials. Times for search and exploration decrease with age, with a highly significant decrease in time between 5 and 7 years. Systematicness increases with age and consecutive trials, and is greater on exploration than on search trials.

Duckworth, E. Piaget rediscovered. Journal of Research in Science Teaching, 1964, 2, 172-175.

The assumption that Piaget's stages of intellectual development are reached independently of instruction and that intellectual development cannot be influenced by teaching is challenged. It is pointed out that Piaget's concept of equilibrium implies the adjustment of the child to environmental contact which requires him to change his cognitive structure. It is suggested that experimental efforts to teach intensively such things as conservation of volume, etc., are "trivial" and are not likely to have a general effect on the child's level of understanding. On efforts to teach the "structure" of a subject, Piaget states, "Teaching means creating situation where structures can be discovered; it does not mean transmitting structures which may be assimilated at nothing other than a verbal level."

Duncan, C. P. Recent research on human problem solving. Psychological Bulletin, 1959, 56, 397-429.

This review summarizes most studies of human problem solving that were published in the period of 1946 through 1957. Only theoretical and experimental studies that dealt with the problem-solving performances of normal human adults are covered. Problem solving is defined as the integration and organization of past experience when the definition refers to all of thinking, and the dimensions of discovery of correct response when reference is made to problem solving specifically.

Dutton, W. H. Measurement of time concepts of verbally disadvantaged primary-age children. Unpublished manuscript, University of California, Los Angeles, 1966.

Verbally disadvantaged children from kindergarten through third grade were given a time concept test (Springer and Stephens) and the Harris revision of the Goodenough Drawing Scale. The time concept test consisted of four major sections: (1) drawing a clock face and telling the time shown; (2) telling when daily events begin or close and describing how the hands on a clock operate; (3) reading time from clocks showing half, quarter hours and minutes; and (4) drawing hands on a clock to show half, quarter-hour, and minutes. Great individual differences were found, and general ability did not correlate highly with ability to tell time. It is suggested that sociological factors seem to be major factors influencing the ability to tell time.

Dvorjashina, M. D. The constantness of perception in children. Child Development Abstracts, 1965, 39, 101.

Constantness of size perception has a significantly higher level than constantness of form perception in young children. Interpretation of facts of the different time development of constants of form and size is given.

Dyer, D. W., & Harcum, E. R. Visual perception of binary patterns by preschool children and by school children. *Journal of Educational Psychology*, 1961, *52*, 161-165.

> In a study of the molecular discrimination aspect of learning to read, preschool children were not found to be significantly more accurate in the right hemifield, as contrasted with first- and second-graders who showed significant superiority in the right hemifield. It had been expected, based on work with adults, that relative accuracy of reproducing elements to the left of fixation would increase with school training in left-to-right reading sequence. It was concluded that "apparently perceptual mechanisms of children at the age when they start school do not wholly duplicate adult mechanism." Smedslund relates this to the developmental studies of perception inspired by Wohlwill.

Elkind, D. The development of the additive composition of classes in the child: Piaget replication study III. *Journal of Genetic Psychology*, 1961, *99*, 51-57.

> Children between the ages of 5 and 8 were tested for their ability to additively compose classes in a systematic replication of one of Piaget's studies. The results agreed with Piaget's finding of three age-related stages in the development of the ability to form class inclusions.

Elkind, D. The development of quantitative thinking: A systematic replication of Piaget's studies. *Journal of Genetic Psychology*, 1961, *98*, 37-46.

> Eighty school and pre-school children were divided into three age groups (4, 5, 6-7) and tested on three types of material for three types of quantity in a systematic replication of Piaget's investigation of the development of quantitative thinking. Analysis of variance showed that success in comparing quantities varied significantly with age, type of quantity, type of material, and two of the interactions. Correlations for types of material were positive, high, and significant. Correlations of comparison scores and W.I.S.C. scores were positive, generally low, and sometimes significant. The results were in close agreement with Piaget's finding that success in comparing quantity developed in three age-related, hierarchically-ordered stages. Piaget's conception of these stages as representing steps in the development of the form and content of children's quantitative thinking was briefly presented.

Elkind, D. Ambiguous pictures for study of perceptual development and learning. *Child Development*, 1964, *35*, 1391-1396.

> Children ranging in age from 6 to 11 years were tested with two comparable sets of ambiguous figures. Normative data are presented for each set at each age level, together with correlations between the two sets and between the combined picture score and Kuhlmann-Anderson I.Q. Both sets of pictures may now be obtained from ADI.

Elkind, D. Discrimination, seriation, and numeration of size and dimensional differences in young children: Piaget replication study VI. *Journal of Genetic Psychology*, 1964, *104*, 275-296.

> Ninety children, 30 at each age level from 4 to 6-7, were tested for their ability to discriminate, seriate, and numerate size differences in one-, two-, and three-dimensional materials. Results show a regular increase with age in the child's ability and show that the dimensionality of materials affects the ease of success, but not the sequence of success, on such tasks. The results are in agreement with those secured by Piaget.

Ellis, N. C., & Arnult, M. D. Novelty as a determinant of spontaneous alternation in children. *Psychonomic Science*, 1965, *2*, 163-164.

> A group of nursery school children traced a series of T-mazes under varying and non-varying stimulus conditions in a situation arranged so that all external stimulus cues could be apprehended by Ss through the entire task. The results of the experiment were interpreted on the basis of Berlyne's (1960) novelty hypothesis, and it was concluded that spontaneous alternation appeared to be related to the activating properties of novel stimuli.

Ervin, S. M. Experimental procedures of children. *Child Development*, 1960, *31*, 703-719.

> Children ranging in age from 8.0 to 8.9 were given a task requiring for solution the discovery of the relation of four variables to the flexibility of rods. Data consist primarily of detailed descriptions of the choices, hypotheses, and explanations used by the children in solving the problem.

Ervin, S. M. Training and a logical operation by children. *Child Development*, 1960, *31*, 555-563.

This study attempted to discover whether two tasks were logically identical. Since only half of the Ss performed the transfer task with complete success it was concluded that the tasks were not identical. The difficulty seems to lie in treating different sensory attributes as functionally equivalent variables, as well as in not equating for differences in the children's previous manipulatory experience. It was found that success on various transfer tasks, once training on relevant experience had been given, was related to spatial and to verbal ability. Such evidence argues more persuasively for maturational aspects in the task than does evidence of age changes in performance when training has been provided.

Feigenbaum, K. D. Task complexity and IQ as variables in Piaget's problem of conservation. Child Development, 1963, 34, 423-432.

Children 4 to 7 years of age were used in a study of Piaget's theory regarding development of the concept of conservation of discontinuous substance. Evidence indicated that stages in the acquisition of the concept were not defined by age. The data also indicated that the children's grasp of the conservation concept tended to vary with their IQ and with the nature of the concrete experimental operations.

Feigenbaum, K. D., & Sulkin, H. Piaget's problem of conservation of discontinuous quantities: A teaching experience. Journal of Genetic Psychology, 1964, 105, 91-97.

Different methods of teaching the principles of correspondence and conservation to children were compared so as to provide additional information on the child's acquisition of the conservation concept. Thirty-one female and 19 male kindergarten children ranging in ages from 61 months to 77 months, were given a pretest, the results of which served to place S into one of three treatment groups. The method of the Reduction of Irrelevant Stimuli was found to be more successful than Reinforcement by Addition and Subtraction. In addition, those who did learn the concept tended to retain this knowledge, at least on a short-term basis.

Flamer, G. B. Conditions of positive and negative transfer in children's verbal learning. Dissertation Abstracts, 1966, 27, No. 4.

The A-B, C-A, C-B chaining paradigm was used in a study to investigate the effects of associatively mediated facilitation and interference on the transfer-list learning of sixth graders. These mediation effects were compared with the effects of warm-up and learning-to-learn, classical interference from this re-pairing on the transfer list of the training list stimuli and responses. The assumption of A-B natural word associations selected from norms was also investigated. The over-all performance of the mediated interference groups was significantly superior to that of the mediated interference, classical interference, and the re-paired groups. Warm-up and learning-to-learn were demonstrated to be facilitating. Evidence of mediated interference was present in the group which received training in the A-B associations but absent in the untrained group. A mediational explanation of transfer-list learning was supported, and "strength of mediating link" was suggested to explain the difference between the trained and untrained "mediated interference" group.

Fletcher, H. J., Davis, J. K., Orr, W. M., & Ross, P. Prompted versus trial-and-error initial object discrimination learning by monkeys, retardates, and preschool children. Psychonomic Science, 1965, 2, 59-60.

After pretraining to a prompt (a light cue), naive monkeys, retardates, and preschool children were tested on two 36-trial object discrimination problems under either a conventional trial-and-error condition or one involving prompting for the first 6 trials. While monkeys' performances on trials 7-36 were equivalent for both conditions, human Ss learned more during 6 prompted trials than during either the same number of conventional trials or during as many conventional trials as were needed to make six correct responses.

Fletcher, H. J., & Orr, B. M. Instructions and observational learning in preschool children. Psychonomic Science, 1967, 7 (2), 83-84.

The effect of different instructions was studied with preschool children, using discrimination problems. One group was instructed to look only, while the second group was told to point. Only the point group learned to solve the problems.

Fountain, W., & Lynn, R. Change in level of arousal during childhood. Behavior Research and Therapy, 1966, 4 (3), 213-217.

The Necker Cube reversal rate is taken as a measure of arousal, and data are reported showing a lowering of arousal level as children get older. The results, together with other characteristics of children's performance, are considered in terms of cortical-subcortial relations (20 ref.).

Fowler, W. L. A comparative analysis of pupil performance on conventional and culture-controlled mental tests. Fourteenth Yearbook of the National Council on Measurements in Education, Education Testing Service, 8-20, Princeton, New Jersey, 1957.

> In 18 schools 355 10-year-old children (including 201 white American non-ethnics, 70 Negroes, and 84 Polish boys and girls) were given three conventional and three culture-controlled mental tests. The culture-controlled tests did not show differences between the sexes, but the girls were superior to the boys on the Henmon-Nelson and the Detroit Alpha. Negro pupils generally scored lower than either of the two white groups. Socio-economic status (as measured by the Warner Index of Status Characteristics) was found to be positively related to test performance, except for the Polish group and the Negro boys where the reverse was true. The type of test used did not greatly alter the IQ obtained. It was also found that teacher estimate of pupil intelligence corresponded most closely with conventional tests.

Fowler, W. L. Cognitive learning in infancy and early childhood. Psychological Bulletin, 1962, 59 (2), 116-152.

> The stress on genetic factors in early cognitive development has led to the amassing of a large body of normative data. However, little interest has been shown in determining the scope and complexity of learning possible during the beginning phases of development. Research literature and theoretical orientations are presented showing the potential value of studying early cognitive learning (201 ref.).

Fowler, W. L. Concept learning in early childhood. Paper presented at the annual meeting of the American Educational Research Association, Chicago, February 1965.

> A model of developmental learning processes in the early years is described and an approach to teaching concepts to normal and culturally disadvantaged three-year-olds is suggested. Emphasis is upon development of cognitive processes and methods of facilitating such development rather than upon measurement or description of intellectual processes. The concept of structure used in classifying and ordering teaching material applies both to the patterning of the external world and the organization of the child's mental processes, and assumes a lawful ordering of reality which produces adaptive structures in the child's mind. Systems of reality such as transportation, reading, and community structure were presented, through a process of analysis and synthesis, so that the children attended

both to simplified parts and wholes; and material was presented in sequential levels of difficulty. Emphasis was placed on use of three-dimensional materials, especially with the youngest children; and small-group play and problem solving situations were used, with instruction progressing toward inducing higher level abstracting and generalizing behavior from the children. It was noted that the small-group play situation was unsuccessful in changing the cognitive functioning of culturally disadvantaged children; and, for this reason as well as the scarcity of systematically programmed material, a decision was made to continue in the direction of careful sequencing of material in projects of compensatory education.

Fowler, W. L. Longitudinal study of early stimulation in the emergence of cognitive processes. Paper presented at the Preschool Education Conference sponsored by the Social Science Research Council, University of Chicago, February 1966.

Studies dealing with all aspects of early cognitive development are reported and discussed. Major topics of concern include maturation vs. learning, measurement, early deprivation, short term learning experiments, longitudinal early stimulation in perceptuo-cognitive learning, motor learning, music and the plastic arts, language, and early training in reading and mathematics. Related topics such as methods, creativity and curiosity are also discussed. The importance of early stimulation is suggested and long range effects of early stimulation in a variety of learning areas are reported. The problem of information-oriented vs. "open-ended" learning programs is discussed, and research conducted by the author with a learning program combining the two approaches is reported in progress.

Friedlander, B. Z. Cognitive reinforcement of curiosity behavior in preschool children. Mental Development Center, Western Reserve University, Cleveland, 1962.

Two groups of children, one with mean age of 48 months and one of 60 months, with a wide range of socio-economic status, were tested individually in a counterbalanced design with three factor analysis of variance; treatments x age x order of presentation of treatments. Results indicated older children were more quickly satiated with repetitious picture sequences. The curiosity of the younger children was less readily satiated by repetition. Differences were significant at .001 level. The study also compared the effects of various reinforcement schedules. Older children showed significant differences favoring fixed ratio vs. continuous reinforcement at the .001 level but younger children showed no differences. Extinction responses were also related to irregularity of reinforcement.

Friedman, S. R. Developmental level and concept learning: Confirmation of an inverse relationship. Psychonomic Science, 1965, 2, 3-4.

The observed positive direct relationship between intellectual skill and school grade level has been noted by several investigators to show an unexpected depression at the fourth grade level. A total of 299 children in the first through fifth grades were tested with a series of sequential-pattern problems. The fourth grade depression phenomenon was observed, and a tentative explanation of the results was offered.

Friedman, S. R., & Tiber, N. The effect of different rewards under two different conditions on the performance of first-graders. Psychonomic Science, 1965, 2, 237-238.

The acquisition and extinction of a discrimination response as a function of reward and condition was investigated. Each S was assigned to one of four reward groups, under one of two conditions. The results indicated that magnitude and type of reward do not significantly affect acquisition performance of first graders, through a differential hierarchy of reward performance is evident in the degrees of resistance to extinction (author's abstract).

Fujinaga, T., Saiga, H., & Hosoya, J. The developmental study of the number concept by the method of experimental education. Japanese Journal of Educational Psychology, 1964, 12, 44-53.

Two methods of teaching number concepts to groups of preschoolers were studied with 26 3-year-old children divided into two groups of 13. In group one, dice-pattern symbols were used to teach the naming of numbers, reconstruction and transformation of dice symbol patterns, correspondences between dice-patterns and other groups of objects, adding patterns, transforming summed patterns, and subtractions. Ss in group two were taught number concepts with traditional techniques stressing memorization, learning to count, adding objects, and subtracting. Most of the 3-year-olds had difficulty with the learning tasks but could profit from either type of group instruction.

Furth, H. G. Conceptual discovery and control on a pictorial part-whole task as a function of age, intelligence, and language. Journal of Educational Psychology, 1963, 54, 191-196.

In order to observe nonverbal conceptual behavior in relation to age, intelligence, and language, normative data for hearing children and deaf children, aged 6-10 and 14 were collected. Major requirement to task was consistent control of choice behavior by the discovered principle of part-whole. In spite of moderate correlations between IQ and performance, improvement with age was only gradual. Just as lack of verbal experience did not handicap deaf Ss, the kind of verbalization after the task was found to be uncorrelated with performance. On basis of these findings, a construct of conceptual control was postulated as being related to IQ but only minimally associated with age or language.

Furth, H. G. Conservation of weight in deaf and hearing children. Child Development, 1964, 35, 143-150.

Eight-year-old deaf children from a state school were compared to a 6½-year-old group on a nonverbal weight conservation problem. However, behavioral criteria of discomfort at giving wrong answers were evident in a much higher percentage of deaf than of hearing Ss. The difference between the two groups was interpreted as a manifestation of restricted experience in deaf children rather than a general retardation in cognitive ability to understand the principle.

Furth, H. G. Research with the deaf: Implications for language and cognition. Psychological Bulletin, 1964, 62, 145-164.

Deaf persons who are deprived of linguistic experience during the formative years appear to provide a valuable opportunity to psychologists concerned with the language-cognition relationship. Deaf persons, performances on nonverbal cognitive tasks were rated, and the deaf were found to perform similarly to hearing persons on tasks where verbal knowledge could have been assumed a priori to benefit the hearing. Such evidence appears to throw doubt on a theoretical position attributing to language a direct, general, or decisive influence on intellective development. It is suggested that the poorer performance of the deaf on some tasks can be attributed to either lack of general experience which is no longer manifest by adulthood or to definite task conditions which favor linguistic habits. (Although this article reviews literature, it reviews studies on the deaf [not cognition] and applies these studies to the area of cognition, therfore is an article on cognition.)

Gagne, R. M. Problem solving and thinking. *Annual Review of Psychology*, 1959, *10*, 147-172.

Ninety-three references reviewing the literature of concept formation and problem solving from 1954 to 1958.

Gagne, R. M. Problem solving. In A. W. Melton (Ed.), *Categories of Human Learning*. New York: Academic Press, 1964, pp. 293-317.

Gagne summarizes very briefly the character of studies done in the general field, and suggests that problem-solving can be regarded as a form of learning. He discusses studies done on various aspects of problem-solving: dependent and independent variables, and individual difference variables. Gagne constructs a hierarchical table of types of learning from basic S-R learning to problem-solving, and suggests that future studies could control individual differences as measured in terms of a set of progressively more complex antecedent capabilities, so that factors in the "instruction" part of the experimental situation can be more successfully isolated and explored.

Gagne, R. M. Elementary science: A new scheme of instruction. *Science*, 1966, *151*, 49-53.

A learning program being tested for sixth-graders is designed to teach the process of scientific inquiry rather than the content only. In an effort to train "creativity," novel ideas are rewarded and children are required to formulate new questions. One part of the program stresses process of observation; classification, communication, number relations, measurement, space-time relations, predictions and inferences; while the other part teaches the formulation of hypotheses: making operational definitions, controlling and manipulating variables, experimenting, formulating models and interpreting data.

Gagne, R. M., & Brown, L. T. Some factors in the programming of conceptual learning. *Journal of Experimental Psychology*, 1961, *62*, 313-321.

A small-step, "guided discovery" program teaching the solution of four number series problems produced greater transfer to new series problems than either a large-step program or a "rule-example" program covering the same material (with 33 ninth and tenth grade boys, 11 assigned randomly to each type of learning program). All three groups improved significantly on the posttest, indicating that all three programs taught the material about equally well. However, on the transfer test, the "guided discovery" program was superior--probably a result of the subject's being required to restate certain concepts, a feature which was lacking in the rule-and-example program.

Galperin, P. Y., & Talyzina, N. F. Formation of elementary geometrical concepts and their dependence on directed participation by the pupils. In N. O'Conner (Ed.), *Recent Soviet Psychology*. New York; Pergamon Press, 1961.

A method of teaching elementary geometry concepts is described which requires students to read definitions of concepts and then respond to examples or non-examples of the concepts, with a reply of yes or no, and why. Feedback is provided, and the method could be given in the form of a program. Method is being tested under several conditions including overt vs. covert responding, and results show few errors by Ss.

Garrison, M., Jr. (Ed.) Cognitive models and development in mental retardation. *Monograph Supplement to American Journal of Mental Deficiency*, 1966, *70*, 149.

The proceedings of a recent conference sponsored by the Woods Schools, the American Association on Mental Deficiency, and the NICHD, in which each session was devoted to different topics related to retardation. Session topics were factor analysis, and the theories of Piaget and Bruner. C. E. Meyers and H. F. Dingman suggested that factor analysis might serve several functions: (a) to reduce redundancy in tests, (b) to suggest research hypotheses about human abilities, and (c) to provide some guidelines for the study of structure of intellect and cognitive development in children. Wohlwill reviewed Piagetian theory concerning the period of concrete operations and Rose R. Olver considered Bruner's three modes of representation (action, imagery, and language) and the manner in which they are integrated; but neither of these presentations was directly related to retardation problems. The discussant, Edward F. Zigler, stated that current optimism toward the solution of these problems may be premature.

Geis, G. L., & Spenser, D. *Bibliography of research using the technique of matching-to-sample*. New York: Columbia University, 1965.

Matching-to-sample is defined for purposes of this bibliography as a procedure in which a standard stimulus or sample and a set of comparative, matching or alternative stimuli, one of which is identical with the sample, are presented, and the subject is required to select one of the alternatives, with reinforcement contingent upon the subject's selecting the appropriate one. Studies involving oddity matching, in which the correct response is the alternative not identical to the sample, and symbolic matching, which does not involve physical identity of sample and reinforced alternative stimulus are also included. The articles listed are briefly annotated.

Gibson, E. J., & Olum, V. Experimental methods of studying perception in children. In P. H. Mussen (Ed.), *Handbook of Research Methods in Child Psychology*. New York: Wiley, 1960, pp. 311-373.

The problem of whether young children perceive globally or analytically is discussed, and literature in the area is reviewed. Children's perception of symbolic forms is discussed in relation to reading readiness, and the problem of whether studies of perception in young children measure the child's discrimination abilities or his comprehension of the task is noted.

Goldman, A. E., & Levine, M. A developmental study of object sorting. *Child Development*, 1963, *34*, 649-666.

An object sorting test of concept formation was administered to Ss in kindergarten, first, second, fourth, sixth, and ninth grades, college, and to established scientists. The concepts employed show developmental changes in part-whole scores suggesting a shift from responses based upon experience to autonomous concepts which transcend personal and perceptual environmental links.

Gollin, E. S. Solution of conditional discrimination problems by young children. *Journal of Comparative and Physiological Psychology*, 1966, *62* (3), 454-456.

Children 37 through 60 months were trained in a discrimination reversal task using a correction procedure, and then tested on a conditional discrimination task. All but the youngest group (37-42 months) learned the reversal task and solved the conditional problem. These results are discussed in the context of earlier findings where non-correction procedures were used.

Goodnow, J. J. A test of milieu effects with some of Piaget's tasks. *Psychological Monographs*, 1962, *76*, No. 36 (Whole No. 555).

Approximately 500 European and Chinese boys between the ages of 10 and 13 were given four Piaget tasks, and Raven's

Progressive Matrices. Among the Chinese boys education varied from little or none to full schooling. Similarities across milieus were more striking than differences--there was an odd difference between the combinational task (closely tied to matrices performance) and the conservation tasks (no such ties)--replication of Geneva results was fair to good. The differences occurring suggest a need for a closer look at the concept stability of reasoning and at the expected interrelationships among various tasks.

Gottschalk, J., Bryden, M. P., & Rabinovitch, M. S. Spatial organization of children's responses to a pictorial display. Child Development, 1964, 35, 811-815.

Children between the ages of 3 and 6 were asked to name all the objects on two forms of a pictorial display. Two weeks later a retest in which the response sequences were scored on the basis of spatial proximity of successive pairs clearly indicated developmental changes in response organization not accountable simply in terms of increasing familiarity.

Grafft, W. D. Cognitive outcomes of the S.M.S.G. mathematics program in grades four, five, and six. Dissertation Abstracts, 1966, 27, (4), 992A.

In a study designed to measure the effectiveness of the S.M.S.G. mathematics program, 242 sixth-grade students who had the program in grades 4, 5, and 6 were tested and compared with a control group of 240 sixth-graders who had the California State Arithmetic Textbook Series during the same 3 years. Differences indicated that modern mathematics, as represented by the S.M.S.G. materials, contribute to greater understanding and transfer for the average and above-average learner without affecting computational achievement. No significant differences were found for slow learners.

Gratch, G. The development of the expectation of the nonindependence of random events in children. Child Development, 1959, 30, 217-227.

Children 6, 9, and 11 were asked to predict what the top card would be in each of a sequence of decks of cards made up of "squares" and "diamonds." In one set of decks the ratio of squares to diamonds was five to four, in a second set, seven to two. The composition of the decks was explained as part of the instructions. Young children 6 and 9 guessed alternately on successive trials, while 11-year-olds appeared to weigh their guesses according to the stated composition of the deck.

Gratch, G. Response alteration in children": A developmental study of orientations to uncertainty. *Vita Humana Basel*, 1964, *7*, 49-60.

> Developmental trends in children's role-taking and thinking were explored in a guessing game with 106 children between the ages of 2 and 8. The guessing pattern changed with age from a tendency to always choose the same hand, to always choosing alternate hands, to choosing alternate hands in an irregular pattern. The children's ability to hide the marble in a deceptive manner and to be competitive with E increased with age. These trends were related through a Guttman scalogram analysis which produced six age-related scale types, indicating a developmental pattern. This pattern involved a shift from acting without taking the game role of the other into account, to changing one's behavior in terms of an anticipation of the other's behavior. There seemed to be a transition point in which the children were able to compete, but were unwilling to do so.

Gratch, G. The use of private speech by head start and middle class preschoolers: An investigation of the mediating function of language. Paper presented at the Southwestern Psychological Association meeting in Arlington, Texas, 1966.

> Poor and middle-class children ages 5.6 and 6.6, were asked to memorize the serial order of sets of familiar pictures, and observed for signs of verbal rehearsal. Two conditions were used, one with and one without induced verbal rehearsal (in which children were asked to give their names for the objects pictured). It was assumed that poor children would show a verbal production deficiency, and that they would not benefit significantly from induced rehearsal. The notion of production deficiency was supported. Only older middle-class children rehearsed verbally without verbal cueing. Half of the verbally cued children, poor as well as middle-class, rehearsed verbally; indicating that poor children are not deficient on mediational behavior, hence no class-based difference in ways of using language in problem solving seems to exist. On three-picture trials, non-rehearsers did better than rehearsers or controls, suggesting that rehearsal may have interferred with recall on the harder task. It is suggested that induced verbal mediation may sometimes be a kind of stimulus pre-training that serves only to involve the children in the task.

Greenberg, J., Gerver, J. M., Chall, J., & Davidson, H. Attitudes of Children from a deprived environment toward achievement-related concepts. *Journal of Educational Research*, 1965, *59*, No. 2.

Attitudes of children from severely deprived environments toward a number of concepts presumed to be important for school learning were measured with 115 fourth-grade Negro children from an urban depressed area. Three groups were classified as "good", "average", and "poor", on the basis of scores on the Metropolitan Primary Reading Test at the end of the third grade. A semantic differential instrument was administered consisting of 13 concepts to be rated on a three-point adjective scale, six evaluative and two potency loadings. Findings revealed generally favorable attitudes, particularly toward important authority figures. Poor achievers tended to assign more positive ratings than better achievers and it was suggested that this, especially for boys, was related to greater defensive needs. On the potency scales, good achievers assigned the most strongly negative ratings, which seemed to demonstrate greater critical ability, self-confidence, and reality orientation, perhaps related to their success in school.

Greene, F. M. Effect of novelty on choices made by preschool children in a simple discrimination task. Child Development, 1964, 35, 1257-1264.

On the second trial of a two-choice discrimination task more Ss shifted to the untried object than chose the same object selected on trial one. These response shifts occurred more often following a nonreinforced first choice. A third, incorrect stimulus added to one of the three later trials was selected more often than either of the other two stimuli present. Ss who made this choice had a higher error rate on preceding and following trials. The trial on which the new stimulus was introduced did not affect the probability of its being chosen.

Greene, F., & Terrell, C. Response shifts in discrimination learning of children at three grade levels. Child Development, 1964, 35, 661-668.

Seven trials of a simple discrimination task were administered to 187 first-, third-, and fifth-grade children and all three expectations from previous investigations of response-shift errors were confirmed: (a) on trial 2, more Ss shifted to the untried object than repeated their original response, (b) more responses were made to a new stimulus introduced on trial five than to the incorrect old stimulus, and (c) Ss who responded to this new stimulus had made more errors on preceding trials than those who made the correct choice. Further, proprotionately more shifters on trial two had made a reinforced choice on trial one, and Ss choosing the new stimulus on trial five also made more errors on the trials following. Response-shift errors may be due to problem-solving efforts.

Griffith, B. C., Spitz, H. H., & Lipman, R. S. Verbal mediation and concept formation in retarded and normal subjects. Journal of Experimental Psychology, 1959, 58, 247-251.

> Retardates and normal 7-year-old Ss were not successful in concept attainment using an abstraction task in which Ss had to discover a similarity among three words, unless they had defined at least two words in terms of an acceptable abstraction. Normal 9-year-olds were relatively successful even when they defined only one word in terms of an abstraction.

Gruen, G. E. Experiences affecting the development of number conservation in children. Child Development, 1965, 36, 963-979.

> Ninety children with a mean age of 5.1 were given pretests and posttests of conservation of number, length, and substance. Half were given pretraining on the verbal discrimination of length and number, and half were not. A third of the Ss in each of the pretraining groups were given direct training on number conservation, a third were exposed to situations designed to produce "internal cognitive conflict," and a third received no training on number conservation. Subjects in the conflict-plus-verbal pretraining group out-performed Ss in the control group without verbal pretraining. There was very little transfer of training from number conservation to other kinds of conservation.

Gruen, G. E. Note on conservation - Methodological and definitional considerations. Child Development, 1966, 37,(4), 977-983.

> Children's responses to the conservation question were classified as conserving or nonconserving according to both Bruner's and Smedslund's procedures. Bruner's criteria classified significantly more responses as conserving than did Smedslund's, thus reflecting a basic disagreement as to the nature of conservation.

Haggard, E. A. Social Status and intelligence: An experimental study of certain cultural determinants of measured intelligence. Genetic Psychology Monographs, 1954, 49, 141-186.

> A total of 671 11-year-olds was given a standard intelligence test. Three experimental treatments were carried out in the next three days, no practice, practice with motivation, and practice without motivation. On the fifth day Ss were retested with the standard test and a revised test to minimize middle-class bids. The marked discrepancy between high and

low status Ss on the standard test decreased when motivation and practice were present.

Halpern, E. The effects of incompatibility between perception and logic in Piaget's stage of concrete operations. Child Development, 1965, 36, 491-497.

Twenty subjects, 5 to 7 years old, 10 empirically and 10 deductively oriented children, were given 36 problems in which perceptual and logical cues competed in problems of inference of measurement. According to prediction the empirical group made more errors than the deductive group, and proportionately more of their errors were on problems where perception directly contradicted logic. The data were seen to clarify further the relationship between perception and logic at the onset of operational (logical) thinking and were interpreted to suggest that the residue of previous modes of thinking (perceptually bound) are still used in certain situations even after logical thinking is manifest, perception still misleading even in the presence of logical thinking.

Harter, S. Discrimination learning set in children as a function of IQ and MA. Journal of Experimental Child Psychology, 1965, 2, 30-43.

The formation of learning set in children was studied in a 3 x 3 factorial design with 3 levels of IQ (70, 100, 130) and 3 levels of MA (5, 7, 9). All Ss were given 10 four-trial object discrimination problems daily until they reached criterion. Significant main effects were discovered for both IQ and MA indicating that the higher the level of both MA and IQ, the more rapid is the formation of learning set.

Heald, J. E., & Marzolf, S. S. Abstract behavior in elementary school children as measured by the Goldstein-Scheerer stick test and the Weigl-Goldstein-Scheerer color form sorting test. Journal of Clinical Psychology, 1953, 9, 59-64.

Children in grades 1 to 5 were given the Stick Test and the Color Form Storing Test. Mean performance increased with age but differences were very slight; even the youngest age group did well on the tests. There were no sex differences in performance on the tests.

Hess, R. D., & Shipman, V. C. Early experience and the socialization of cognitive modes in children. Child Development, 1965, 36, 869-886.

A total of 160 Negro mothers and their 4-year-old children selected from four different social status levels participated in a study of the mother-child communication system. The data show social status differences among the four groups with respect to cognitive functioning and use of linguistic codes.

Higgins, C., & Silvers, C. M. A comparison of the Stanford-Binet and the colored raven progressive matrices IQ for children with low socio-economic status. Journal of Consulting Psychology, 1958, 22, 465-468.

The assumption that verbal test items are more susceptible to degrees and varieties of social exposure and cultural deprivation, while non-verbal items are free of this influence, was not supported in a study with 789 pupils 7 to 9 years of age, from a low socioeconomic area, using the Stanford-Binet and Ravens Progressive Matrices Test. Negro children obtained lower scores on the non-verbal test, whereas white children showed no significant difference between Stanford-Binet and CRPM measures.

Hill, E. H., & Giammatteo, M. C. Socio-economic status and its relationship to school achievement in the elementary school. Elementary English, 1963, 40, 265-270.

A total of 223 third-graders participated in this investigation of the relationship of socioeconomic status (SES) to vocabulary, reading comprehension, arithmetic skills, problem-solving, and composite achievement scores. Correlation of test scores to SES suggested SES is an important factor in school achievement. Largest differences were found in problem solving skills.

Hill, S. D. Chronological age levels at which children solve three problems varying in complexity. Perceptual and Motor Skills, 1962, 14. 254.

Preliminary results concerned with establishing minimal CA levels for solution of three problems are reported. Object discrimination oddity, and conditional-oddity were used in a modified Wisconsin General Test Apparatus.

Hill, S. D. The performance of young children on three discrimination-learning tasks. Child Development, 1965, 36, 425-435.

Children 1, 4, 6, and 12 years old were tested on object-discrimination, oddity, and conditional-oddity problems. The object-discrimination problem can be done by 1-year-olds, the oddity problem by 6-year-olds, and the conditional-oddity problem by Ss between 6 and 12 years of age. The major response tendency found was a position preference on the part of 1-year-old Ss on the object-discrimination problem. With more complex problems and older age groups, Ss appeared to vary in the type of responses they made both among themselves and over trials.

Holloway, H. D. Effects of training on the SRA primary mental abilities (primary) and the WISC. Child Development, 1954, 25, 253-263.

Half of a group of 107 kindergarten children, 57 females and 50 males, mean age 5 years 6 months, was trained for 14 weeks, using the SRA Learning To Think Series. The trained group made significantly greater gains on the PMA Test than the Control. The differences on the WISC between the two groups were not significant. Gains were not related to differences in initial level of ability.

Hood, H. B. An experimental study of Piaget's theory of the development of number in children. British Journal of Psychology, 1962, 53, 273-286.

A replication of Piaget's hypotheses regarding development of pre-number concepts was carried out with a normal and a mentally-retarded group of children to determine whether (a) a group of normal English speaking children and (b) a sample of mentally retarded children and adults would show the same general trends in development of pre-number concepts as Piaget's Ss. The factors of mental and chronological age were also considered, as well as the relation of stage of development to ability in arithmetic.

Hudgins, B. B. Problem solving in the classroom. New York: Macmillan, 1966.

This book attempts to translate research findings into classroom practices and to provide guidelines to help the average teacher facilitate acquisition of problem solving behavior. While the book is small in size and the author limits the research reports discussed to a manageable number and describes these reports quite well, nevertheless the topic is much too profound to suggest that the book might serve as "incidental" reading. It seems to be the kind of book that would either have to be rather thoroughly discussed or one that is read in the context of other related material.

Hughes, D. H. Study of concept formation with superior, average, and retarded children. Dissertation Abstracts, 1960, 20, 3378-3379.

> Three groups of children (gifted, average, and retarded) were equated for MA (9.6 to 10.6) and given a battery of tests to measure various aspects of concept formation. It was found that the mean of the superior group on the verbal part of the Weigl-Goldstein-Scheerer Color Form Sorting Test (CSF) was at the abstract-conceptual level of concept formation and was significantly higher than the verbal means of the average (functional level) and retarded (concrete level) groups. Results seem to support the hypothesis that there is a difference in the nature and extent of concept formation among superior, average, and mentally retarded children of the same age. A second hypothesis, that the three intelligence groups would differ significantly from one another in conceptualizing ability, was not substantiated.

Humphrey, J. H. An exploratory study of active games in learning of number concepts by first-grade boys and girls. Perceptual and Motor Skills, 1966, 23, (2), 341-342.

> Two methods of instruction in number concepts were compared with first-grade children. Using the differences between pre- and posttest scores as criteria, the results suggest that all children learned regardless of approach used; although the game technique seemed to be more effective with boys.

Hunt, E. B. Concept learning: An information processing problem. New York: Wiley, 1962.

> Empirical and theoretical studies of concept formation and problem solving are discussed and related to computer information processing models.

Hunter, I. M. L. The solving of three-term series problems. British Journal of Psychology, 1957, 48, 286-298.

> Sixty-four 11-year-old children and 32 16-year-olds were given 16 problems of the three-term series type. The older children show evidence of solving these problems by articulated sequences of analytical judgments which accord with the varying logical structures of the problems, show no influence of atmosphere effect, and show marked practice effects. Increasing age seems to bring increasing appreciation of the structural characteristics as such, together with increasing skill in dealing with serial relations which are progressively more remote from the perceptual-motor level of behavior.

Hunter, I. M. L. The solving of five-letter anagram problems. British Journal of Psychology, 1959, 50, 193-206.

> The anagram-solving process was studied with 72 students and 144 different five-letter anagrams. The process seems to involve recurring trial and check activity in which the nature and sequence of the tries are determined jointly by the thinker's set, linguistic knowledge, and preference for certain forms of letter position arrangement. A replication with 12- and 15-year-old youths suggested that improvement in anagram-solving performance is a matter of long-term learning extending over months or even years (16 ref.).

Huttenlocher, J. Effects of manipulation of attributes on efficiency of concept formation. Psychological Reports, 1962, 10,(2), 503-509.

> Thirty seventh-grade boys solved concept formation problems requiring S to select the correct block of a set where form and brightness were relevant dimensions, and the treatment variable involved manipulating the blocks (M) vs. no manipulation (NM). A light and buzzer confirmed correct instances and incorrect ones received no feedback. Each S of group M had a matched S in group NM who was presented with the same sequences of instances (as constructed by the Group M S) but was not allowed to manipulate the blocks. Group NM performed significantly better than group M. It was surmised that planning of manipulative responses distracted group M Ss from the task of remembering and interpreting material previously presented.

Huttenlocher, J. Some effects of negative instances on the formation of simple concepts. Psychological Reports, 1962, 11, 35-42.

> Twenty-six seventh-grade boys were tested on a series of one-dimensional concept-formation problems. Two instances were presented for each problem, the first of which eliminated half the possible hypotheses and the second of which eliminated all others except for the answer. Two negative instances resulted in the poorest performance and negative-positive produced the best. An interpretation of the problem-solving process involving storage by Ss of initial instances in the form presented to them and study of dimensions that change value on succeeding instances fit the results of the experiment.

Huttenlocher, J. Development of formal reasoning on concept formation problems. Child Development, 1964, 35, 1233-1242.

The development of ability to solve simple concept formation problems on the basis of different sequences of positive and/or negative instances was investigated. Earlier analysis of information processing on such problems had suggested that the number of intellectual steps required for problem solution varied with the type of sequence. Since abilities of small children to carry out such steps seem particularly limited, it was predicted that the accuracy of these Ss' conclusions would be poorest on sequences requiring the greatest number of steps. The results were consistent with this prediction.

Iijima, F. The child's ordinal number concept and its formation. Japanese Journal of Educational Psychology, 1966, 14, 79-87. (Psychological Abstracts, 1966, 40, No. 1150)

Five-year-old Ss in three experimental and one control group of Ss each were given tasks in 1-to-1, reversal, and random correspondence. Cardinal and ordinal number perceptual tasks were also presented. E instructed one group in the verbal label of the concept, the second group in the number system, and the third in the verbal label and number system. Results indicate no significant differences between experimental groups, although each experimental group performed significantly better than the control group.

Iijima, F. The developmental sequences of the child's conception of number. Japanese Journal of Educational Psychology, 1966, 14, 25-36. (Psychological Abstracts, 1966, 40, 8704)

Ss totaling 200 divided into two groups were given the child's concept of number and analyzed in regard to magnitude and in terms of a set of eight tasks under different stimulus conditions. The task ranged from divisions of aggregates into smaller ones which comprise the same number of elements, to tasks dealing with seriation and ordinal numbers. The younger group ranged from age 4.0 to 4.5, while the older group ranged from age 4.6 to 4.11. Major findings were: (1) when they compare the number of two aggregates, Ss are influenced by the perceptual configuration; (2) the magnitude of number is scalable, according to the order of difficulty; and (3) the younger group cannot understand 1-1 correspondence. The developmental sequences of the number concept appears to cover the following periods: (1) Number operations not understood at all, (2) lower numbers are understood, (3) verbal label understood, (4) ability to abstract numerical dimensions, and (5) understanding of the ordinal number and conservation concept.

Inhelder, G., & Piaget, J. *The growth of logical thinking from childhood to adolescence*. New York: Basic Books, Inc., 1958.

> The development of logic from childhood to adolescence from the point of view of experimental reasoning with an elaboration in terms of logistic analysis is presented in a unified approach.

Iscoe, I., & Pierce-Jones, J. Divergent thinking, age, and intelligence in white and negro children. *Child Development*, 1964, *35*, 785-797.

> A total of 267 Texas white and Negro school children aged 5 to 9 was given an Unusual Uses Test. Results indicated that divergent thinking scores were significantly higher for Negroes. Correlations of these scores with WISC was low but significant for both races. There was no significant main effect for age, but race showed significant effects alone as well as in interaction with age. Flexibility scores showed no over-all relations with age or race. Certain interesting comparisons by WISC subtests, flexibility categories, and five age levels are discussed and interpreted. Doubts are raised concerning the notion of creative thinking as a simple function of age or of intelligence -- there is need for more developmental studies of originality in varied social and cultural contexts.

Jackson, S. The growth of logical thinking in normal and sub-normal children. Unpublished masters dissertation, University of Manchester, England, 1963.

> Forty-eight children with normal IQ's were matched with 40 children with IQ's between 40 and 60, and all were given Inhelder's experimental tasks. Results indicated that the ability to think at a certain logical level is dependent upon situation, that among normals responses are generally in line with the ages at which Piaget suggests certain levels of logical thinking are reached, but that Piaget's definitions of stages of logical thinking appear to require more critical examination.

Jeffrey, W. E. Variables in early discrimination learning: I. Motor responses in the training of a left-right discrimination. *Child Development*, 1958, *29*, 269-275.

> Four-year-olds learned to press buttons oriented in the direction of figures representing left and right, although Ss were unable to label the stimuli according to spatial orientation, and the button response training was found to facilitate subsequent application of right and left labels. It was not clear whether

results indicated mediation or acquired distinctiveness of cues. In another study, with tonal frequencies, pretraining of Ss to match tones with a piano or by singing facilitated the learning of association of buttons with piano tones. Facilitation was felt to be a result of discrimination set.

Jeffrey, W. E. Variables in early discrimination learning: III. Simultaneous vs. successive stimulus presentation. Child Development, 1961, 32, 305-310.

Using 5-year-old Ss it was found that a simultaneous discrimination involving pressing a button closer to the positive stimulus which appeared on the left or right was easier than a successive discrimination when Ss were required to push a button on the left to positive stimulus and on the right to the negative. No differences were found when the successive discrimination procedure required Ss to push a single button when the positive stimulus was present and not to respond to negative stimuli.

Jeffrey, W. E., & Cohen, L. B. Effect of spatial separation of stimulus, response, and reinforcement on selective learning in children. Journal of Experimental Psychology, 1964, 68, 577-580.

Sixty children of two age levels were randomly assigned for training under five possible combinations of spatial contiguity or separation of stimulus, response, and reinforcement. Two levels of stimulus difficulty were used. Children learned only in the two conditions where stimulus-reward contiguity was shown probably to be a matter of transfer from previous training under conditions of stimulus-response contiguity in a repeated-measures design. Age was not an important variable in learning the easy discrimination, and the difficult discrimination proved to be too difficult for both age groups.

Jensen, A. R. Learning abilities of Mexican-American and Anglo-American children. California Journal of Educational Review, 1961, 12, 147-159.

Children in grades 4 and 6 with IQ levels from 60 to 120 or above were compared on immediate recall, serial learning, and p-a learning of familiar and abstract objects. Anglo-American children of low IQ were slower learners than Mexican-American children of same IQ. Mexican-American children of above average IQ did not differ significantly in learning ability from Anglo-American children of same IQ. High IQ was very rare among Mexican-American population.

Jensen, A. R. Learning ability in retarded, average, and gifted children. *Merrill-Palmer Quarterly*, 1963, *9*, 124-140.

> Thirty-six junior high school children, mean age 14 years, classified as educable mental retardates were compared on a selective learning task with average and gifted children in the same school. The task required learning, by trial and error, to associate five or six different stimuli with five or six different pushbutton responses. The retarded group showed high correlations between first trial scores and IQ's, which diminished somewhat on second trial, after E had given them extra explanations of the task involved, suggesting that ability to understand instructions was the crucial factor relating to IQ. Variability was much greater among the retarded, who showed in some cases marked improvement with practice. It was concluded, since the retarded group spanned the entire range of learning ability as measured by this task, that more varied and specific types of diagnostic intelligence tests are needed. It was also suggested that these normal and fast learning retarded Ss were not retarded in a primary sense but had failed to learn at crucial periods in their development certain kinds of behavior relating to school learning and the kinds of knowledge and skills tapped by IQ tests.

Jensen, A. R. Learning in the preschool years. *Journal of Nursery Education*, 1963, *18*,(2), 133-138.

> Children 20 months old who had been exposed to "doll" in many verbal contexts showed greater ability to discriminate object "doll" from many objects. In another experiment, children shown an object for an equal length of time with one group allowed to handle object and the other group receiving visual experience alone were compared. Learning was more rapid with the group receiving both visual and tactile experience. The author also reviewed verbal mediation studies which indicate more rapid learning when task comes under verbal control. Implications for nursery education are discussed.

John, V. P. The intellectual development of slum children: Some preliminary findings. *American Journal of Orthopsychiatry*, 1963, *33*, 813-822.

> This study examines patterns of linguistic and cognitive behavior in a sample of Negro children from various social classes. Three major levels of language behavior--labeling, relating, categorizing--were analyzed. Consistent class differences in language skills were shown to emerge between groups of Negro children of different socioeconomic class.

It was concluded that acquisition of more abstract and integrative language seems to be hampered by the living conditions in the homes of lower-class children.

Johnson, D. M. Problem solving and symbolic processes. Annual Review of Psychology, 1950, 1, 297-310.

Reviewing the literature from March 1948 to July 1949, studies of learning are categorized as: experimental analysis of problem solving processes, individual differences in problem solving and judgment, the development of concepts (39-item bibliography).

Johnson, D. M., & O'Reilly, C. A. Concept attainment in children: Classifying and defining. Journal of Educational Psychology, 1964, 55, 71-74.

Ss who have learned to classify objects correctly in concept-learning experiments often cannot define the class. In this study Ss were given materials appropriate to both classifying and defining tasks, and the definitions were reliably evaluated. One group was given practice defining without knowledge of results. The frequency of acceptable definitions, after classification had been learned, was 65% for all groups combined. The group with defining practice gave significantly more acceptable definitions than a control group. Success on a transfer classification task correlated with success in defining.

Johnson, R. C., & Zara, R. C. Relational learning in young children. Journal of Comparative and Physiological Psychology, 1960, 53, 594-597.

Two groups of 15 nursery school children were trained to respond to the larger stimulus either with a single or double discrimination task. Five Ss in each group were then tested on near transposition, five on far transposition, and five on "very far" transposition, with all responses rewarded. The Ss who learned a double discrimination reached criterion significantly more rapidly in training and transposed all along the size dimension; Ss who learned a single discrimination transposed only in the near test.

Kagan, J., & Lemkin, J. Form, color, and size in children's conceptual behavior. Child Development, 1961, 32, 25-28.

A sample of 35 girls and 34 boys, median age 5-8, were asked to match with a standard, paper cut-out of geometrical forms differing in color, shape and size. Both sexes preferred form as a basis of similarity, with color and size following in that order. No age differences found for boys but older girls were less likely than younger girls to use color as basis for matching. Older boys were more likely to use color than older girls.

Kagan, J., Moss, H. A., Sigel, I. E. Psychological significance of styles of conceptualization. In J. C. Wright and J. Kagan (Eds.), Basic cognitive processes in children. Monograph of the Society for Research in Child Development, 1963, 28, No. 2, pp. 73-112.

Ss of all ages were studied in a series exploring conceptualizing styles as measured by responses to a sorting test with human figures and a test requiring categorization of objects. High analytical scores were found to correlate positively with numbers of differentiated responses to the Rorschach Ink Blot Test, while relational or other responses correlate with undifferentiated holistic or vague Rorschach responses. Analytical responses were found to increase with age in grades 1-6, to increase more with boys than girls, and to relate to other areas of behavior. Analytical Ss consistently showed longer attention spans, greater attention to environmental detail, less motor activity, more interest in intellectual or sedentary pursuits, and more independence from others; while non-analytical Ss were impulsive, unable to inhibit motor activity, more dependent upon others and less interested in intellectual pursuits.

Kagan, J., Pearson, L., & Welch, L. Modifiability of an impulsive tempo. Journal of Educational Psychology, 1966, 57 (6), 359-365.

Forty first-grade Ss were trained to be reflective under two different tutoring conditions. In one group of Ss the trainer first persuaded the child that he and the S shared some interests and attributes, while the second group was not treated in any way that would lead the child to believe he and the trainer shared characteristics. Both groups showed longer response latencies after training. The condition of perceived high similarity to trainer facilitated the training for some girls, but not for boys.

Kagan, J., Rosman, B. L., Day, D., Albert, J., & Phillips, W. Information processing in the child: Significance of analytic and reflective attitudes. Psychological Monographs, 1964, 78, No. 1 (Whole No. 578).

A series of studies with children in grades 1 through 4 inquired into the immediate and historical determinants of a preference for analytic conceptual groupings. Results revealed that two more fundamental cognitive dispositions each contributed variance to the production of analytic concepts--the tendency to reflect over alternative solutions or classifications in situations in which several response alternatives are available simultaneously, and the tendency to analyze visual arrays into their component parts. These two dispositions are relatively independent of each other, orthogonal to verbal skills, and each influences the frequency of errors in perceptual recognition tasks. Degree of reflection over alternative solution hypotheses (as measured by response time) displayed remarkable generality across a variety of tasks and marked intra-individual stability over a 1-year period. There was an inverse relation between the production of analytic concepts and extreme degrees of hyperactivity and distractibility contemporaneously as well as during the first 8 years of life (17 ref.).

Keislar, E. R. Abilities of first grade pupils to learn mathematics in terms of algebraic structures by teaching machines. U. S. Office of Education, Cooperative Research Project No. 1090, University of California, Los Angeles, 1961.

A group of 136 first-grade children was instructed in modern mathematics by a teaching machine in a 15-week study to determine to what extent very young children can learn mathematics in terms of algebraic structures. The teaching machine featured projected slides and a three-button response panel; and the program also incorporated a set of Cuisenaire Blocks, and plastic symbols for "plus," "minus," etc. Results supported the hypothesis that first graders could learn algebraic structures, with the experimental group performing significantly better than control groups on both a "creative" test and a test of problem solving, and equal to control groups on arithmetic type skills.

Keislar, E. R. Teaching children to discover: A problem of goal definition. Paper presented at the annual meeting of the California Advisory Council on Educational Research, San Diego, Novemeber 1967.

A distinction is drawn between teaching by discovery and teaching children to discover, the latter being viewed as the acquisition of the ability to solve problems. The wide range of studies dealing with problem solving is noted, and the need for more rigorous definition of problem solving is suggested. The importance of problem solving as an educational goal and the open-ended vs. the goal-directed orientations to teaching problem solving are discussed. Dimensions of problem solving are listed under environmental events, problem-solving process, nature of learning outcome, and individual differences. Suggestions are outlines for construction of problem-solving tests, methods of defining a class of problems and selection of goals for instruction in problem solving. The importance of transfer as a goal for problem-solving instructions is emphasized.

Keislar, E. R., & McNeil, J. D. Teaching scientific theory to first grade pupils by auto-instructional devices. *Harvard Educational Review*, 1961, *31*, 73-83.

A 3-week instructional program was administered to a group of first graders using an automatic instructional device which projected colored slides for recorded vocal commentary with a button-press response. Content consisted of 432 items relating to several basic statements of molecular theory as related to evaporation and condensation. A posttest was given Ss and controls requiring use of terminology and explanations of physical phenomena. Ss scored 66% vs. 22% for controls. It was concluded that first graders can learn abstract scientific language and use it in explaining physical phenomena.

Keislar, E. R., & McNeil, J. D. Teaching science and mathematics by auto-instruction in the primary grades: An experimental strategy in curriculum development. In J. E. Coulson (Ed.), *Programmed learning and computer-based instruction*. New York: John Wiley & Sons, Inc., 1962.

The importance of long-range curriculum planning with regard to programmed learning studies is discussed and a study with young grade-school children learning scientific principles by teaching machines is described, as well as a study which attempted to teach first graders algebraic structures and certain basic principles of mathematics in a 15-week auto-instructional program, using Cuisenaire Blocks.

Kendler, H. H., & D'Amato, M. F. A comparison of reversal shifts and non-reversal shifts in human concept formation behavior. *Journal of Experimental Psychology*, 1955, *49*, 165-174.

The hypothesis that the presence of appropriate symbolic cues (even though connected to the wrong sorting response) would facilitate concept formation was supported in an experiment using a card-sorting task.

Kendler, H. H., & Kendler, T. S. Inferential behavior in preschool children. *Journal of Experimental Psychology*, 1956, *51*, 311-314.

Three- and 4-year-old children received three experiences in a maze-like situation. A-B and X-Y led to subgoals; B-G led to a major goal. The A-B subgoal served as the start of the B-G experience. When Ss were given a choice between A and X in order to get to G, significantly more Ss chose A.

Kendler, H. H., & Kendler, T. S. Effect of verbalization on reversal shifts in children. Science, 1961, 134, 1619-1620.

A discriminatory reversal task was given to 4- and 7-year-old children to determine the effect of naming stimuli at these two age levels. Naming affected performance although it was not clear whether there were any age related effects.

Kendler, H. H., Kendler, T. S., Pliskoff, S. S., & D'Amato, M. F. Inferential behavior in children: I. The influence of reinforcement and incentive motivation. Journal of Experimental Psychology, 1958, 55, 207-212.

Three studies, involving 384 preschool children and providing three separate experiences, were executed in an experimental situation. Two of these experiences led to sub-goals while the third led to a blue container. During training the blue container held the major goal for some Ss, while it was empty for other Ss. Results indicate that Ss who received the major goal at the blue container during the learning trials and who could see the major goal during the test trial performed better than Ss for whom only one or neither of these conditions prevailed. It was concluded that inferential behavior is influenced by independent variations of reinforcement and motivational variables.

Kendler, T. S. Concept formation. Annual Review of Psychology, 1961, 12, 447.

Concept formation is taken to imply the acquisition or utilization, or both, of a common response to dissimilar stimuli. Studies using various theoretical models of concept formation are discussed, as well as studies on concept formation relating to stimulus factors, motivation and reward factors, response factors, and genetic factors.

Kendler, T. S. Verbalization and optional reversal shifts among kindergarten children. Journal of Verbal Learning and Verbal Behavior, 1964, 3, 428-436.

Two experiments were performed in which children were presented with an initial discrimination involving a relevant and irrelevant dimension. After criterion was attained, a second discrimination was presented in which both dimensions were present and relevant and the reinforcement pattern was changed. This discrimination was called the optional shift because S had the option of reaching criterion on the basis of a reversal shift, an extra-dimensional shift, or a nonselective shift. A test series which followed attainment of criterion on the optional shift provided the means of inferring the basis of the optional shift. In each of the experiments one group of children was instructed to precede choices during the initial discrimination with a sentence that labelled S+ and S- (V Group). Another group was run on the same discrimination but was given no instructions about verbalization (C Group). The V Group had significantly more optional reversers in both experiments.

Kendler, T. S., & Kendler, H. H. Inferential behavior children: II. The influence of order of presentation. Journal of Experimental Psychology, 1961, 61, 442-448.

An experiment was conducted on children between 30 and 65 months of age to determine whether inferential behavior resulting from the linkage of two discretely acquired behavior segments is influenced by the order in which these segments are presented during training. Explanation of inference by the invocation of either the anticipatory goal mechanism or secondary reinforcement would imply that order would be variable. The results failed to confirm this implication.

Kendler, T. S., Kendler, H. H., & Carrick, M. A. Verbal labels and inferential problem solutions of children. Child Development, 1966, 37 (4), 749-763.

The spontaneous integration of 2 separate behavior segments to attain a goal are more efficiently executed by third graders than kindergarteners. If a common overt label is applied to the stimulus element common to the two segments, integration is facilitated at the kindergarten level and interfered with at the third-grade level. This seems to point to the operation of mediated generalization in inferential problem solving.

Kendler, T. S., Kendler, H. H., & Learnard, B. Mediated responses to size and brightness as a function of age. American Journal of Psychology, 1962, 65, 571-586.

Children at ages 3, 4, 6, 8, and 10 were presented with an initial discriminative task of concept formation that included a relevant and irrelevant stimulus-dimension. After criterion they were presented with a shift in which the same stimuli were employed but the pattern of reinforcement was reversed. Results confirmed the prediction that the proportion of children who respond with a reversal-shift increases with age. Both the non-reversal and inconsistent shifts were expected to decrease with age. The prediction was verified for inconsistent shifts only. A relationship between learning and choice-behavior such that mediators learn more rapidly than nonmediators was suggested. Research suggested there is a relationship between the ability to connect words with actions and the tendency toward reversal.

Kendler, T. S., Kendler, H. H., & Wells, D. Reversal and nonreversal shifts in nursery school children. *Journal of Comparative and Physiological Psychology*, 1960, *53*, 83-88.

In a study to investigate verbal mediation in young children, Ss were taught labels for stimuli and given a discrimination problem. When positive stimulus became negative (reversal), Ss who had learned the initial discrimination quickly and were thought to be developing mediating responses relevant to the task were superior to slower learners in the reversal variation and inferior in the condition where learned labels had become irrelevant (non-reversal). It was suggested that there is a stage in development in which verbal responses though available do not readily mediate between external stimulation and overt responses.

Kennedy, K., & Kates, S. L. Conceptual sorting and personality adjustment in children. *Journal of Abnormal and Social Psychology*, 1964, *68*, 211-214.

Twenty-four well-adjusted and 24 poorly-adjusted sixth-grade children were compared on the Gelb-Goldstein-Weigl-Scheerer Object Sorting Test. Poorly-adjusted children made significantly more inadequate sortings than well-adjusted children. High- and average-intelligence children were more adequate in their object sorting than low-intelligence children. It was suggested that relatively poorly-adjusted children may not be as able to reduce environmental complexity and assign meaning to events as do relatively well-adjusted children. High and average intelligence, at this age level, contributes to the ability to abstract and use shared properties as a grouping principle.

Kessen, W. Questions for a theory of cognitive development. *Monographs of the Society for Research in Child Development*, 1966, *31* (5), No. 107, 55-70.

The question of epistemological assumptions underlying all theories of cognition is raised, and areas to be focused on in the development of a psychology of cognition are suggested and discussed. The importance of examining the footings of psychology, in particular the psychology of cognitive development, is emphasized; and continued empirical investigation is advocated with the suggestion that premature precision be avoided.

Kessen, W., & Kuhlman, C. (Eds.), Thought in the young child. Monographs, 1962, 27, No. 2.

Includes papers directed in general toward Piaget's work discussion of major themes and comparison with other views of cognition. The first several papers comprise a general introduction to problems in cognitive development, while the remaining papers focus more closely on aspects of children's thinking and Piaget such as perception and inference, behavior theory and simulation of thought.

King, W. H. The development of scientific concepts in children. British Journal of Educational Psychology, 1961, 31, 1-20.

A total of 1200 children was given 70 questions involving scientific concepts. Responses were tabulated in terms of percentage for boys and girls with increasing CA, and the types of questions considered in terms of the age trends. Of the 70 questions, 24 showed definite increases with age, but 13 showed no relation with age. The latter seems to be dependent upon formal teaching.

King, W. H. The development of scientific concepts in children. II. British Journal of Educational Psychology, 1963, 33, 240-252.

Following up a previous study, the responses of children to 20 science questions were related to age and ability represented by scores on a verbal and nonverbal test. A relationship between scores on these criteria and the science questions was established. It was also found that the rate of growth of scientific knowledge for boys and girls 10 years of age show no significant differences. There is significant differentiation in knowledge of science concepts with secondary school children.

King, W. L. Learning and utilization of conjunctive and disjunctive classification rules: A developmental study. Journal of Experimental Child Psychology, 1966, 4, (3), 217-231.

Conjunctive and disjunctive classification rules under instructions denoted the relevant attributes in advance were learned and showed transfer to subsequent problems employing the same rule by children as well as adults. When asked to identify which of the two rules was employed in a subsequent problem, the conjunctive rule was more difficult than the disjunctive at every age. Although rule learning ability differed for children of different ages, rule identification did not.

Klausmeier, H. J., & Loughlin, L. J. Behaviors during problem solving among children of low, average, and high intelligence. *Journal of Educational Psychology*, 1961, *52*, 148-152.

Differences among groups of children of low, average and high IQ were found in observed behaviors as they solved problems, especially in subskills such as noting and correcting mistakes independently, verifying solutions, and using a logical approach. Differences in performances among individuals within IQ groups were also large.

Kleinmuntz, B. (Ed.), *Problem Solving - Research Method and Theory*. New York: Wiley and Sons, Inc., 1966.

The volume contains the preceedings of Carnegie Tech's first annual symposium of cognition. Contributors cover the range from information processing theorists to exponents of mediation theory and the strict operant approach; and, in method, ranging from perceptive armchair theorizing to introspective and verbal protocol, original verbal-learning experiments, and cumulative records of operant conditioning.

Klugh, H. E., Colgan, K., & Ryba, J. A. Developmental level and speed of relational concept formation: A possible inverse relationship. *Psychonomic Science*, 1964, *1*, 89-90.

In two studies involving concept problems of different difficulty levels, first-grade children reached a learning criterion in fewer trials than fourth-grade children. A significant interaction was observed between grade level and trials to relearn the concept. Older Ss showed more savings.

Klugh, H. E., & Roehl, K. Developmental level and concept learning: interaction of age and complexity. *Psychonomic Science*, 1965, *2*, 385-386.

A study utilizing 60 children aged 5-6 and 9-10 demonstrated a strong interaction effect between developmental level and problem complexity on trials to solution of a relational concept formation problem. Some Ss from both developmental groups were unable to verbalize the concept even though meeting a "trials correct" criterion of solution.

Kohlberg, L. Early education: A cognitive-developmental view. Paper presented at the annual meeting of the American Educational Research Association, New York, 1967.

Literature on the development of mental abilities is reviewed, and the cognitive developmental view is presented and related to current theory and practice in preschool education. The assumption of a critical period in early childhood is questioned, as well as the value of teaching specific school-related skills or information at an earlier age. It is suggested that more useful goals for preschool programs may be developed by focusing on factors related to ego development (such as attentional set, attitudes toward adult resource figures, style of conceptualizing); and, in general, relating the preschool activities to a cognitive-structured viewpoint.

Kohnstamm, G. A. An evaluation of part of Piaget's theory. *Acta Psychologica*, 1963, *5*, 313-336. (*Psychological Abstracts*, 1965, *39*, 70).

Five-year-old children were trained in one of Piaget's most critical operations: the quantification of inclusion relations, which is normally to be reached by most children at age 7-8. Contrary to learning study by one of Piaget's collaborators, Albert Morf, which started from the assumption that the child should discover the solution for himself, in this study direct instruction was given, with complete explanation of the problem and examples of correct solutions. Of one group of 20 children, 18 learned to give correct answers to the inclusion questions in many different experimental situations. These learning results remained intact during periods of three weeks and 6 months, in which no new training was given. The learning results are much better than Morf's and seem to be incompatible with part of Piaget's theory.

Lacey, H., & Goss, A. E. Conceptual block sorting as a function of number, pattern of assignment, and strength of labeling responses. *Journal of Genetic Psychology*, 1959, *94*, 221-232.

Conceptual block sorting was related to number, pattern of assignment, and degree of mastery of nonsense syllable responses to height and/or size dimensions of block stimuli. There were 16 blocks which represented combinations of tall or short, large or small, and square or circular, top or bottom areas, black or white. The four, three, or two labels assigned to the blocks by height and/or big size were learned by the paired associates method to criteria of 9/16 or 14/16 correct anticipations. Each of the 10 groups which learned the labels consisted of 10 Ss. Upon completion of verbal learning, four trials, each involving 12 blocks, were administered to test for transfer to sorting by height-size. Also given the block sorting task were controls (N-10) and an instructions group (N-10), neither of which had had prior experience with the blocks. The Ss of the latter group were told to sort the blocks by height-size. Both number of labels and degree of mastery of the labels were directly related to number of height-size placements, but pattern of assignment by height or by size had no significant effects. The influence of number of labels was somewhat greater for the 14/16 criterion than for the lower level of mastery. Analysis of Ss' principles of sorting revealed that those who said they sorted by height-size made more height-size placements than those who could not state the height-size principle. Also, ability to state the height-size principle was directly related to the number of labels required. Our interpretation of these findings is that number and strengths of nonsense syllable responses influenced height-size placements by increasing intra-category similarity and decreasing inter-category similarity. Alternatively, the two experimental variables may have differentially activated the pre-experimentally acquired responses of stating the height-size principle and its associated discriminative verbal responses. Such sets of responses would also be expected to increase intra-category similarity and decrease inter-category similarity and thus influence subsequent sorting by height-size.

Lacey, H. M. Mediating verbal responses and stimulus similarity as factors in conceptual naming by school age children. Journal of Experimental Psychology, 1961, 62, 113-121.

Using 8- to 11-year-old children, author studies effect of verbal mediating response and stimulus in conceptual naming by means of a design in which four patterns of possible relationships among initiating stimulus, mediating stimulus and responses, and terminating responses were combined with sets of more similar or less similar initiating stimuli. Overall findings are consistent with predictions based on the four different patterns.

Lavin, D. The Prediction of Academic Performance. New York: Russell Sage, 1965.

An analysis and review of the research related to predicting academic success is provided. The introductory chapter reviews recent research in this area, summarizing what is known about the role of intellective factors, personality characteristics, and the social settings that are assumed to be related to performance. Definitions and dilemmas in this research area are presented clearly, although not in great detail. The basic questions are touched upon. It is pointed out that while grades tend to be the measure of academic performance, they may not be an adequate criterion. Criticism is offered of the frequent failure to define the terms overachievement and underachievement, of lack of standardization in predictor measures, and of the considerable intercorrelation of presumably "independent" predictor variables. Longitudinal studies are commended as a method of dealing with the stability of predictor variables through time.

Lee, L. C. Concept utilization in preschool children. Child Development, 1965, 36, 221-227.

This study investigated preschool children's utilization of the following conceptual dimensions: color, size, number, form, sex type (objects used predominantly by males or females) and similarity of components of the stimulus. The Ss, ages 3.6-6.5, were divided into three age groups and a concept-identification task was administered using a modified oddity-problem technique. Ease of concept identification was not an increasing monotonic function of age. The ease with which the six concepts were identified varied among the age groups, and color and size items appeared to be more difficult for 6-year-olds than for 3-year-olds.

Lee, L. C., Kagan, J., & Rabson, A. The influence of a preference for analytic categorization upon concept acquisition. Child Development, 1963, 34, 433-442.

In a study to assess the relationship between a preference for analytic grouping of familiar picture stimuli and the ease of learning three kinds of concepts, 30 third-grade boys were selected on the basis of the number of analytic responses produced in a simple test for preferences in pairing familiar objects; Ss were then asked to learn six concepts (two analytic, two inferential, two relational) in a standard concept formation task. Analytic boys learned the analytic concepts more readily than the other two, whereas the nonanalytic boys learned the relational concepts with greater ease.

Lenrow, P. B. Preschool facilitation of convergent and divergent cognitive modes: What price acceleration? Paper presented at the biennial printing of the Society for Research in Child Development, New York, March 1967.

> Two preschool programs were designed--one to facilitate convergent thinking, or effective accomodation ot externally imposed demands, the other to facilitate divergent thinking, or the child's interpreting and shaping a situation in terms of his own ideas and interests. These were compared with a third "minimal" preschool program in a study to determine the effect of one type of instruction of children's abilities to cope with the other mode. Ss were three groups of 25 children between 4.5 and 5.6, half middle-class and half from disadvantaged homes. Assessment procedures included Stanford-Binet, a logical thinking test, and Q-sort descriptions of child's behavior in two contrasting situations. Dispersion of change scores was significantly greater for convergent than divergent training group; and children trained in the convergent mode who scored significantly higher on the logic test, more often gained on the divergent mode as well.

Lesser, G. S., Fifer, G., & Clark, D. H. Mental abilities of children from different social-class and cultural groups. Monographs of the Society for Research in Child Development, 1965, 30, 1-114.

> Verbal ability, reasoning, number facility, and space conceptualization were studied in first-grade children from Chinese, Jewish, Negro, and Puerto Rican ethnic groups. Each group was divided into middle-space and lower-class groups, each in turn being divided into equal numbers of boys and girls. Thus, a 4 x 2 x 2 analysis-of-convariance design included a total of 16 subgroups, each composed of 20 children with a total sample of 320 first-grade children. Effort, responsiveness to the tester, and age of the subject were controlled statistically. The major findings were: (1) Differences in social class placement do produce significant differences in the absolute level of each mental ability but do not produce significant differences in the patterns among these abilities; (2) Differences in ethnic-group membership do produce significant differences in both the absolute level of each mental ability and the patterns among these abilities; (3) Social-class and ethnicity do interact to affect the absolute level of each mental ability but do not interact to affect the patterns among these abilities, showing that several mental abilities are related to each other in ways that are culturally determined.

Levi, A. Remedial techniques in disorders of concept formation. Paper presented at the annual meeting of the American Psychological Association, Chicago, September 1965.

> The paper represents an attempt to base a remedial technique for cognitive dificiency on the theoretical orientation of Piaget, as

well at those of Werner, Harlow and Luria. A previous exposition of techniques aimed at the preoperational child is extended, and specific techniques to help those children who appear to be unable to free themselves to move from lower to appropriately high levels of cognitive functioning are described. For a child who has apparently a normal or dull-normal intelligence and who is of an age where the attainment of logical principles, syntactical transformations and operational qualifiers would ordinarily already be appropriate, but in fact seem to be inadequate, a variety of problem exercises are devised.

Levi, A. Treatment of a disorder of perception and concept formation in a case of school failure. Journal of Consulting Psychology, 1965, 29, 289-295.

A report is given of a year's specialized treatment of an 11-year-old boy brought to a psychiatric clinic for failing schoolwork. Initial psychological testing indicated a commonly encountered picture, that is, grossly deviant test patterns suggestive of CNS dysfunction, with particularly poor visual-motor and conceptual performances. Treatment goals were: (a) to realize consciously the notion of category, (b) to acquire a store of categories, (c) to learn to scan categories, for appropriate selection from them. Perceptual confusion was to some extent reduced through verbal techniques. At the end of the year of treatment, retesting showed improved test performance; school grades were reported as satisfactory; a follow-up six months later indicated that school performance continued adequate.

Levin, G. R., & Baker, B. L. Problem sequence in children's learning of a concept system. American Psychologist, 1963, 18, 350.

Auto-instructional program on geometry was used to study the relative effectiveness of presenting program items in standard or random order. Two matched groups of second graders went through two versions of the program which differed only with according to the sequence of items in the third unit. The control group went through those items in the standard order; the experimental group in a random sequence. No statistically significant differences between the groups were found on indices of acquisition, retention, or transfer. The generality of the findings was discussed in light of program effectiveness and the correlation of I.Q. and performance. (J.A.)

Levy, N. M., & Cuddy, J. M. Concept learning in the educationally retarded child of normal intelligence. Journal of Consulting Psychology, 1956, 20, 445-448.

A concept-learning task was given to 23 pairs of fourth-grade children matched for age, sex, and very roughly for socioeconomic status. The Ss IQs ranged from 98 to 103 on the California Test of Mental Maturity. In each pair, one S was up to grade placement while the other was behind from .5 to 2.5 years in achievement as measured by the Stanford Achievement battery. Eighteen of the normal achievers made fewer errors than their matched underachievers. Eleven Ss reached the criterion of 11 consecutively correct choices. Of the 16 Ss correctly verbalizing the principle, 14 were normal achievers while only 2 were underachievers. Ten Ss met both criteria and all of these Ss were normal achievers. All of these results were statistically significant below the .01 level of confidence.

Ling, B. C. The solving of problem-situations by the preschool child. _Journal of Genetic Psychology_, 1946, _68_, 3-28.

Several months of training improved ability of infants 6-15 months old to discriminate simple geometric shapes such as circle, square, triangle, etc., irrespective of changes in size and position.

Lipsitt, L., & Serunian, S. Oddity-problem learning in young children. _Child Development_, 1963, _34_, 201-206.

Fifty-seven Ss, ranging in age from preschool through third grade, learned to respond to the odd color presented in one of three stimulus sources. Results show that "the rapidity of oddity-problem solution is a function of chronological and, indirectly, of mental age. The relationship of IQ scores to performance did not reach significance for the 50 Ss on whom such scores were available." The possibility that other variables might interact with CA and thus influence the determination of minimum age is discussed.

Lipsitt, L. P., & Spiker, C. C. _Advances in Child Development and Behavior_. Volumes I and II. New York: Academic Press, 1964.

The book is the first in a series designed to provide critical syntheses for teachers, researchers, and others in areas peripheral to their primary focus of interest; and to researchers whose programs are within such problem areas. None of the volumes is to be organized around a particular theme---articles will be solicited on the basis of current interest. In addition to consideration of the literature, new research is reported including reports of negative findings. This volume includes: a review of infant responses to complex and novel stimulation; research in the field of verbal behavior; an article on stature and weight in North American boys; an argument for hypothesis and strategy learning models for learning set data; a review of learning in the first year of life; description of functional anslysis of conceptual development and some processes of social reinforcement; a mathematical extension of the Hull-Spence theory by means of a principle of stimulus interaction; a discussion of over-constancy as found in space perception; and discussion of discrimination learning of retardates.

Lovell, K., Healey, D., & Rowland, A. D. Growth of some geometrical concepts. *Child Development*, 1962, *33*, 751-767.

A population of educationally subnormal (ESN) and regular primary school children were given 12 experiments from The Child's Conception of Geometry. Findings broadly confirmed those of Piaget, although the number of children at the various stages are not always in line with the results obtained with the Geneva children. It was found that 14- to 15-year-old E.S.N. children have the operational mobility of about an average child aged 7½. The educational implications of two experiments are briefly discussed.

Lovell, K., Mitchell, B., & Everett, I. R. An experimental study of the growth of some logical structures. *British Journal of Psychology*, 1962, *53*, 175-188.

Several experiments of the type suggested by Piaget and Inhelder's book were given to a population of primary and educationally subnormal (ESN) school children. Findings among the former group generally confirm those of the Geneva school. It has been possible to extend Piaget and Inhelder's findings by giving a number of tests to the same children and by making a comparative study of primary and ESN school pupils.

Lovell, K., & Ogilvie, E. A study of conservation of substance in the junior school child. *British Journal of Educational Psychology*, 1960, *30*, 109-118.

Junior high school children were tested individually, along the lines initiated by Piaget, in an effort to trace the development of the concept of invariance of substance and to establish the arguments used by children to justify their answers. The three stages in the development of the concept given by Piaget have been confirmed, and some children give reasons for conservation similar to those proposed by him. On the other hand, evidence does not always agree with Piaget or enable us to prove or disprove the assumption that the child arrives at the concept of conservation because he is able to argue logically in concrete situations.

Lovell, K., & Ogilvie, E. A study of the conservation of weight in the junior school child. *British Journal of Educational Psychology*, 1961, *31*, 138-144.

> Tested individually were 364 junior high children, using procedures initiated by Piaget. While results similar to those of Piaget are obtained using his criteria for invariance of weight, it was found that children who are conservers of weight in this type of test are often non-conservers in other tests of conservation of weight suggesting that, while logical thought may be a necessary condition for conservation of weight, it is not a sufficient condition. Sheer experience of the physical world seems to play a more important role than Piaget reckons.

Lowe, R. C., Jr. A developmental study of part-whole relations in visual perception. Dissertation Abstracts, 1963, 23, 3495.

> A study concerned with the developmental aspects of part-whole perception investigated the influence of wholes on parts, and parts on wholes in perception of young children. Three hypotheses were formulated: (1) the perception of parts will be most affected by the characteristics of the whole at the youngest age level, this effect tending to alter the parts so that they appear more similar to the whole; (2) the tendency for the parts to influence the whole will increase with age; (3) the results will further vary as a function of the objective difference between the part and whole. Twenty Ss from each of three age groups (kindergarten, grade 2, and grade 4) were presented with five small rectangles (RS) and two large rectangular configurations (SR) individually and asked to match the small parts to a variable rectangle manipulated by E. Responses were compared with those of 60 control Ss who matched the shape of the same small part presented alone, thus out of context. Results supported the hypothesis that parts were assimilated to the shape of the wholes most at the youngest age level. Twenty Ss were presented the three SR figures and two of the RS figures individually and asked to match the shape of the whole configuration to a variable rectangle manipulated by E. Responses were compared with those of 60 control Ss who matched figures of the same dimensions as the large configurations, but which had no separate and discrete parts. Results did not systematically support the second hypothesis. Depending on the stimuli, the influence of parts on wholes increased, decreased, or remained the same with age. It is suggested that in early part-whole perception, whole-characteristics of stimuli are dominant and can be expressed in the parts and part-characteristics, to a lesser extent, can be expressed in the wholes. With development, there is a general decrease in the mutual influence of part and whole on each other.

Lundsteen, S. W. Listening, reading and qualitative levels of thinking with regard to problem solving in the 6th grade. Paper presented at the annual meeting of the California Educational Research Association, Palo Alto, California, 1966.

One of a series of studies involving construction of differing experimental measures of thinking used at various grade levels. A 48-item measure of qualitative levels of thinking concerning problem-solving stories was constructed and evaluated in an attempt to investigate the relationship between (1) scores concerning qualitative levels of thinking (abstract, functional and concrete), (2) scores derived from listening to material designed to elicit problem solving, (3) scores derived from reading material designed to elicit problem solving, (4) scores from a measure of general reading ability (STEP), and (5) scores from a measure of general scholastic ability (SCAT). It was expected that factor analysis would yield separate listening and reading factors. Four factors tentatively labeled as a result of the study were (1) Abstract Graphic Verbal Ability, (2) Concrete Auditory Quality, (3) Functional Auditory Quality, and (4) Functional Graphic Quality. Results are felt to lend some support to the theory of a constellation of listening abilities related to qualitative levels as measurable entities.

Lundsteen, S. W. Thinking improvement project (TIP). Paper presented at the annual meeting of the California Educational Research Association, Los Angeles, March 1967.

Nine-hundred fifth-grade children in California are participating in a language arts program emphasizing innovation in curriculum materials and teaching methods. Areas of concentration are problem solving, listening, and qualitative levels of thinking. Heavy use is made of television in training of teachers and administering of tests and programs. Subjective reports from teachers and students participating has been very favorable.

Lundsteen, S. W., Michael, W. B. Validation of three tests of cognitive style in verbalization for the third and sixth grades. Paper presented at the annual meeting of the American Educational Research Association, Chicago, 1966.

A study was made to measure interrelationships at each of two grade levels among three experimental tests designed to measure three qualitative levels of verbal functioning: a test of critical listening, the STEP Reading test, and SCAT. Results showed that measures of verbal thinking with an abstract quality seem closely related whether stimulus material is a word, paragraph or story; but substitution of one process for another is not necessarily warranted. Significant differences between means of third- and sixth-grade Ss were found on all three measures; with third-grade Ss scoring higher on concrete measure than other measures, and sixth-grade Ss higher on abstract quality than other measures. More complex verbal material appeared to stimulate a preference for abstract cognitive style even at the third-grade level.

Lunzer, E. Some points of Piagetian Theory in the light of experimental criticism. Journal of Child Psychology and Psychiatry, 1960, 1, 192-202.

In replication of Piaget's study on the understanding of volume, Piaget's findings were confirmed. However, in a second study, Piaget's contention that the conservation of displacement volume and learning to multiply to calculate volume depend upon notions of infinity and continuity was not supported. The logical interdependence of concepts thus does not indicate their psychological relationship.

Luria, A. R. Higher Cortical Functions in Man. New York: Basic Books, 1966.

First published in Russia in 1962, this volume included factual description and theoretical interpretations. Neurologically caused behavior disturbances are catalogued, and the underlying local cortical lesions and methods of investigation are described. Theoretical discussion centers on the problem of function localization.

Maier, H. W. Three Theories of Child Development. New York: Harper and Row, 1965.

This book attempts to bring aspects of selected developmental theories to bear upon practice in the helping professions. Summaries of the theories of Erickson, Piaget, and Sears, a theoretical characterization of the helping process and some implications of the selected theories of development for various phases of this process are presented. There is an attempt to relate each theorist to the position to which he is most related. Basic assumptions peculiar to each theory are identified in terms of approach to theory construction, etiology of behavior, fundamental human values, core of human values, core of human behavior, the newborn, the physical, and the social and ideational environment; and each theory is described in its stance toward development. An attempt is made to achieve an integration which might be of help to clinical practitioners.

Maltz, H. Ontogenetic change in the meaning of concepts as measured by the semantic differential. Child Development, 1963, 34, 667-674.

Ss from four age levels (second, fourth and sixth grades, and college) were given a task consisting of seven concepts being rated along 9 scales. The connotative meanings of the concepts, as measured by the semantic differential, change with age in such a way that the change becomes more apparent as the age difference becomes greater. It was also concluded that the meaning of concepts is less consistent in the youngest children than in the others; and it is suggested that, although it may need further modification, semantic differential is a useful and valid instrument for measuring the meanings concepts to children.

Mandler, G. Response factors in human learning. Psychological Review, 1954, 61, 235-244.

An attempt is made by means of a series of formal definitions and assumptions to develop a model for use with human learning and thinking problems which emphasizes the importance of response factors. The theory is applied to stimulus differentiation, the relationship between overt and symbolic responses, and the transfer and overlearning of these responses (30 references).

Marsh, G. Effect of overtraining on reversal and nonreversal shifts in nursery school children. Child Development, 1964, 35, 1367-1372.

In a previous investigation it was shown that nursery school children, like nonverbal organisms, learn a nonreversal shift faster than a reversal shift. This experiment of overtraining, which is known to facilitate a reversal shift in infrahuman subjects, would have a similar effect on young children. The results indicate that overtraining had a facilitating effect on reversal shift and no significant effect on a nonreversal shift. It is suggested that this evidence supports mediational explanation of the effect of overtraining, although it may be that the mediators are of a perceptual type previously used to explain similar effects in infrahuman subjects rather than mediation by implicit verbal labeling.

Martin, W. E. Quantitative expression in young children. Genetic Psychology Monographs, 1951, 44, 147-219.

A series of visual stimuli designed to elicit quantitative expressions of number, size, and pattern were shown to 150 3- to 7-year-old children. Each subject was given a traditional test of number ability. With advancing age, children's ability to handle concepts of number, size, and quantity increases. The findings support the conclusion: "That which determines a child's behavior in a quantitative situation which is unstructured...is not only his knowledge and ability in this specific area, but also his motivation toward and his sensitivity to quantitative characteristics in that situation."

Martin, W. E., & Blum, A. Effects of irrelevant cues on inter-test generalization in discrimination learning of normal children. *Psychological Reports*, 1960, *7*, 399-404.

> An oddity-choice situation used to determine age changes in effects of irrelevant cues (etc.). Results demonstrated an improvement in performance favoring boys and a sex-age interaction in sensitivity to stimulus cues.

Matsuda, M., & Matsuda, F. The effects of verbal reinforcement combinations on acquisition and extinction of discrimination learning in infants, children and feeble-minded children. *Japanese Journal of Educational Psychology*, 1966, *14*, 65-70. (*Psychological Abstracts*, 1966, *40*, 1150)

> Ss were presented with a series of pairs of figures and asked to choose a "correct" figure from each pair. For response E presented one of three possible combinations of verbal reinforcement: (1) right for a correct response, nothing for incorrect (RN); (2) nothing for a correct response, wrong for incorrect (NW); (3) right for a correct response, wrong for incorrect (RW). Some feeble-minded Ss did not learn under any of the three conditions, but all third-grade Ss were able to learn the problem. Kindergarten Ss learned best under the NW condition, while third-grade Ss learned best under RN condition. Rates of incorrect responses decreased linearly in normal Ss but decreased suddenly near the end of the learning in the feeble-minded.

McConnell, O. L. Perceptual versus verbal mediation in the concept learning of children. *Child Development*, 1964, *35*, 1373-1383.

> Concept learning in nursery school and second-grade children was investigated in relation to prior learning conditions. Positive transfer resulted in perceptual arrangement which emphasized a dimension relevant for the conceptual task and negative transfer when the dimension was irrelevant, with the latter effect stronger for younger children. In a conflict situation where perceptual arrangement was irrelevant and verbal response relevant, older children showed positive transfer and younger children negative transfer. Findings are discussed in terms of mediational theory, preferred mediators and experimental method.

Meece, R. S., & Rosenbaum, S. Conceptual thinking of 6th grade children as measured by the vigotsky block test. *Psychological Reports*, 1965, *17*, 195-202.

Nine measures of Vigotsky Block Test performance were obtained from 50 sixth-grade girls with mental ages ranging from 8 to 14. Of 45 intercorrelations between the measures and the mental ages, and among the measures themselves, 20 were significant. In general it was found that an increase in mental age results in greater ability to verbalize the major concept involved in the Vigotsky test.

Melton, A. W. (Ed.), Categories of Human Learning. New York: Academic Press, 1964.

Papers included were presented at a symposium on the psychology of human learning held at the University of Michigan in 1962 sponsored by the Office of Naval Research. Papers centered on the interrelationship of different categories of human learning, with the focus on definitional and taxonomic issues. Considered were classical and operant conditioning, rote verbal learning, probability learning, incidental learning, concept learning, perceptual motor skill learning, and problem solving learning. It was the concensus that future symposia stressing or including definitional and taxonomic issues raised in the present symposium were needed...that the interrelatedness of one type of learning and every other should be recognized in structuring special category-oriented symposia.

Mermelstein, E., Carr, E., Mills, D., & Schwartz, J. The effect of various training techniques on the acquisition of the concept of conservation of substance. Paper presented at the annual meeting of the American Educational Research Association, New York, March 1967.

In a study to assess the effects of various training procedures on the attainment of the concept of conservation of substance, 5-year-olds were trained in one of four ways: cognitive-conflict training, multiple-classification training, verbal-rule training, and language-activation training. Results did not confirm the prediction that the cognitive conflict method would be successful in inducing conservation of substance, and none of the training methods produced significant effects. Results are discussed in terms of Piagetian theory.

Mermelstein, E., & Shulman, L. The effect of lack of formal schooling on number development: A test of Piaget's theory and methodology. U.S. Office of Education Cooperative Research Project No. 2321, 1967.

Study attempts (1) to examine the effects of a period of non-schooling on attainment of the concept of conservation by Negro children; (2) to investigate differences between the verbal and non-verbal assessments of the same cognitive structure; and (3) to assess the differential effects, if any, of systematically varying the types of questions utilized in verbal test of conservation. The performances of Negro 6- and 9-year-olds from Prince Edward County, Virginia, a community which had been without public schools, were compared with those of Negro children from a community which had regular schooling; and all children were compared on both verbal and non-verbal tests of conservation. To assess the differential effects of questioning, three techniques of questioning were experimentally varied. Findings revealed no significant differences attributable to the effects of non-schooling. Differences between verbal and non-verbal tasks were found to be highly significant. One of the three questioning conditions appeared to influence performance on verbal conservation tasks.

Meyer, W. J., & Seidman, S. B. Age differences in the effectiveness of different reinforcement combinations on the acquisition and extinction of a simple concept learning problem. Child Development, 1960, 31, 419-429.

Four combinations of reinforcers at two developmental levels were compared. The combinations were Right-Wrong, Right-Nothing, Nothing-Wrong and Buzzer-Nothing. The Ss, ages 4-5 and 8-9, were required to learn the concept "larger than" by responding to pairs of blocks. The Nothing-Wrong and Right-Wrong groups were superior in acquisition, whereas the Nothing-Wrong group was superior to all other groups on the extinction series.

Meyer, W. J., & Seidman, S. B. Relative effectiveness of different reinforcement combinations on concept learning at two developmental levels. Child Development, 1961, 32, 117-127.

Three reinforcement pairs--Right-Wrong, Right-Nothing, and Buzzer-Nothing--were compared for effectiveness with kindergarten Ss and 3rd graders. A previous study suggested the existence of an age by treatment interaction in the acquisition of a simple discrimination problem. The present study failed to confirm the previous results, and it was concluded that the negative reinforcer is more effective than the positive reinforcer.

Meyers, C. E., & Dingman, H. F. The structure of abilities at the preschool ages: Hypothesized domains. Psychological Bulletin, 1960, 57, 514-532.

The possibility of factorial descriptions of the abilities of infants and young children is discussed, with special emphasis on test construction as well as showing the potentials already existing in the current repertory of test materials. A series of factors which may ultimately be identified at the late preschool level are suggested, with some speculations regarding the early appearance of the hypothesized factors.

Moshin, S. M. Effect of frustration on problem solving behavior. *Journal of Abnormal and Social Psychology*, 1954, *49*, 152-155.

This study attempts to determine the effect of frustration in one task on performance in the task immediately following. The results indicate some spread of the effects of frustration induced in one task to the performance of another task.

Montague, D. O. Arithmetic concepts of kindergarten children in contrasting socioeconomic areas. *Elementary School Journal*, 1964, *64*, 393-397.

An investigation was made of social-class differences in arithmetic concepts in kindergarten children. A. K. Ruddell's Arithmetic Concepts Inventory was administered to 51 low socioeconomic status (SES) and 31 high socioeconomic status kindergarten children who had been in school for seven months. The inventory includes subtests of Enumeration, Quantitative Relationships, Symbol Recognition, Social Usage, and Problem Solving. A significant difference was found between classes on total score on the inventory with lower SES pupils scoring lower on the arithmetic concepts tests.

Montessori, M. *Spontaneous activity in education: The advanced montessori method*. Vol. I. New York: Robert Bentley, 1964.

(Reprint of original published in 1917.) This volume presents her theory for the education of children aged 7 to 11, which is highly idealistic and moralistic, drawing as much on philosophy as on the available psychology and pedagogy of that day. The chapter on the author's contribution to experimental science shows clearly her empirical approach. This volume covers such matters as the preparation of teachers, the desirable educational environment, the nature and nurture of attention, will, intelligence and imagination.

Montessori, M. *The Montessori elementary material: The advanced Montessori method*. Vol. II. New York: Robert Bentley, 1964.

> (Reprint of original published in 1917.) This volume examines a developmental approach to the teaching of grammar, reading, arithmetic, geometry, drawing, music, and metrics (poetical rhythm).

Montessori, M. *Dr. Montessori's own handbook.* New York: Robert Bentley, 1965.

> (Reprint of the original published in 1914.) In this book the author summarizes her view of spiritual development of children analogous to their physical growth; her "Children's House;" her devices for the measurement of physical growth (height); and the didactic material designed to promote motor, sensory, and language development. Montessori materials are described and illustrated briefly, in simple language.

Morf, A., Smedslund, J., Vinh-Bang, and Wohlwill, J. F. *The learning of logical structures*. Paris, France: Presses University, 1959, Vol. 9.

> Sec. I. "Development of Behavior and Learning," by Vinh-Bang. This section discusses the similarity between Piaget's hierarchical structure of behavior and Guttman's cumulative model and presents evidence that children can learn specific results more easily than they can grasp the logical structure of the situation.
>
> Sec. II. "Learning of a Concrete Logical Structure," by A. Morf. Author details some attempts at teaching the inclusion relation (if B equals A plus A, then B includes A) to children 4-7 years and concludes that the inclusion relation cannot be taught by using particular cases.
>
> Sec. III. "Learning the Concepts of Conservation and Transivity of Weight," by J. Smedslund. This contains two experiments showing that it is possible to teach conservation of weight to children 5-7 years, that acquisition of the conservation relation tends to be positively related to acquisition of the transivity relation and that it is difficult to teach the notion of transivity.
>
> Sec. IV. "A Learning Experiment in the Field of Number Conservation," by A. Wohlwill. This is an attempt to teach children aged 4 to 6 that the number of points remains invariant when a set of points is rearranged. A nonverbal choice method was used to measure attainment of the conservation concept. Only 5 of the 34 Ss made

completely correct choices on the three criterion trials. The correlation between the choice criterion and Piaget's usual verbal test of conservation is positive but low.

Moyer, K. E., & Gilmer, B. von H. Attention spans of children for experimentally designed toys. *Journal of Genetic Psychology*, 1955, *87*, 187-201.

Attention spans (of 681 boys and girls in the age range of 18 months to 7 years) were determined individually on each child in a laboratory playroom or in a home environment. Mean attention spans of 15 to 40 minutes were obtained. The length of time children will concentrate in play with toys depends primarily on the use of the right toy for the right age (19 references).

Muller, R. Deductive thinking of eight-year-old children. *Psychologie*, 1966, *13*, 274-282. (*Psychological Abstracts*, 1966, *40*, 1152).

The progress of three groups of young grade school children in the learning of spelling was compared. Group 1 was taught by using rules. Group 2, by visual-motoric memory, and Group 3 did not receive any special training. The results indicate that children were able to use the rules correctly, thus can think deductively.

Murry, F. B. Some factors related to the conservation of illusion-distorted length by primary school children. Paper presented at annual meeting of the American Educational Research Association, New York, 1967.

A series of studies related to the conservation of length were reported. A conservation test with two equal sticks made to appear unequal showed a significantly greater number of conservers above the median group age of 6.91 than below it, and the only significant difference in mean constant error between conservers and nonconservers in the kindergarten group. In another study Ss were asked to distinguish between the real and illusory aspects of stimuli, with length conservers performing significantly better on the four stimuli involving length. A significant number of conservers from the first study switched to nonconservation on an operational task. In a training study, Ss trained in conservation of length by a reversibity and cognitive conflict procedure did significantly better than a control group.

Nadel, J. Activities of comparison between ages three and six. *Enfance*, 1966, *1*, 7-22. (*Psychological Abstracts*, 1966, *40*, 1037).

Children aged 3 to 6 were divided into nine age groups. The children compared four saucers of which two were alike and two different, and eight boxes, two alike and the rest different; they were tested in a study to observe the development of the ability to categorize. The results indicate: (1) the box test seems more suitable for clear revelation of the spontaneous evolution of qualitative differentiation, (2) the greater importance of color and the lesser importance of form on the saucer test suggests that the very young rely on differences when making comparisons. The competing theories of conceptual development are not resolved.

Nadirashvili, S. A. Development stages of generalization in school children and the problems of their modeling. *Voprosy Psikhologii*, 1964, *6*, 78-88. (*Child Development Abstracts*, 1965, *39*, 108).

It was found that children 7 to 11 years up to the 5th grade used empirical generalization and identified common features in positive examples. The identification of necessary features of a class by means of system generalization began only after the fifth grade. The break in the activity of generalization between these stages was observed in the 5th and 7th grades. Information from positive and negative examples was considered independently and the common features could not yet be united in one notion. For the structural characteristic of the level of empirical generalization the model of "class of classes" was used but for the characteristic of system generalization the perfect normal disjunctive form of combination of expressions was used. Problems with realization of these structures in the process of generalization were discussed on the basis of Uznadze's theory of set.

Nass, M. L. The effects of three variables on children's concepts of physical causality. *Journal of Abnormal and Social Psychology*, 1956, *53*, 191-196.

The effects of three variables on children's concepts of physical causality were studied. It was found that: (1) the nature of the causal thinking of withdrawn children is at a significantly less mature level than the causal thinking of normal children, (2) Questions about phenomena whose causal agents are not accessible to direct experience yielded significantly more non-naturalistic responses than did questions about phenomena whose causal agents are more accessible, and (3) Supernatural explanations increased with questions worded to suggest the possibility of such causes.

Nelson, P. A. Concepts of light and sound in the intermediate grades. Science Education, 1960, 44, 142-145.

> The investigation concerned how children acquire scientific concepts and whether socioeconomic background and intelligence are related to the learning. Ss were 118 boys and girls from intermediate grades of elementary schools of two different socioeconomic environments. Tests given to pupils before and after instruction were: (1) Otis quick-scoring mental abilities; (2) multiple choice word classification; (3) Oxendine sound; (4) and (5) two object classification tests in areas of light and sound. Results showed: (1) Gain in principle interest = 270% (light), 248% (sound); (2) Concept gain = 120% (sound), 260% (light); (3) significant improvement directly related to group for "sound"; (4) Grade and social status not related to improvement but were related to level of performance; (5) All tests relate to one another and to intelligence; and (6) No significant difference between two socioeconomic groups.

Nikkel, N., & Palermo, D. S. Effects of mediated associations in paired associate learning of children. Journal of Experimental Child Psychology, 1965, 2, 92-102.

> This investigation was conducted to demonstrate that mediated associations can facilitate or impair the performance of children on a verbal paired-associate task. Natural language associates derived from free-association norms in the mediational chain were used in the investigation. Two chaining paradigms were tested: A-B, B-C, A-C, and A-B, C-A, C-B. A-B learning was assumed from the normative data for sixth-grade children. Sixty Ss learned by the method of anticipation two lists of S-R pairs constructed such that each S served as his own control for the three experimental conditions: facilitation, interference, and control. The results for both paradigms revealed the facilitation condition to be significantly superior to the interference condition, with the control condition falling between. These results provide support for a theory of mediated association and demonstrate that existing language habits can influence the acquisition of new verbal habits by implementing the mediating process.

Norcross, K. J., & Spiker, C. C. The effects of type of stimulus pretraining on discrimination performance in preschool children. Child Development, 1957, 28, 79-84.

> In an investigation of the effects on discrimination performance of the degree of similarity of previously acquired stimulus names, 30 kindergarten children learned nonsense syllable names for two

pairs of faces (two boys and two girls). Names attached to one pair were highly similar, while those attached to the other pair were dissimilar. In a transfer task Ss had to name and push one of four buttons for each picture presented singly. More incorrect names and fewer correct motor responses followed presentation of either of the similarly named pair than the dissimilarly named pair. This held true even if incorrect names were corrected before motor response occurred. It was concluded that response-produced verbal cues may differentially affect a transfer task depending upon the generalization properties of the verbal cue components.

Norman, C., & Rieber, M. The facilitation of concept formation in children by the use of color cues. Research Bulletin, 1967, 38, Department of Psychology, University of Western Ontario, London, Canada.

> This study investigated the learning of single alternation (SA) and double alternation (DA) concepts in children, with and without the help of color cues. SA was found to be an easier concept to learn than DA, and color cues were found to facilitate learning, especially in the DA schedule. When color was made irrelevant to determine the dependence on color cues of Ss who had learned with color, it was found that once the sequence of correct responding was established a large proportion of Ss apparently discovered the more abstract underlying principle and no longer depended on the facilitating cue.

O'Donnell, J. P. Observing-response acquisition and its effects on discrimination performance in normal and retarded children. Dissertation Abstracts, 1966, 27, 987-988.

> Forty normal and 40 retarded children received training on a modified WGTA. In the first phase observing response acquisition was investigated in a 2 x 2 x 2 factorial design as a function of reinforcement (differential-nondifferential), instructions (specific-nonspecific), and normal-retarded. Specific instructions oriented the subjects to the response-reward contingencies. Data indicated that on the first training day all groups responded at about chance, although at the termination of training the differentially reinforced groups were significantly superior in observing response performance to the nondifferentially reinforced groups. It was found in the differentially reinforced groups that the specific instruction subgroups made observing responses significantly more frequently than the nonspecific instruction subgroups; that such instructions facilitated both retardate and normal performance, but that normals benefited far more than retardates from instructions; and that significant

observing-responses acquisition occurred. In the second phase in which successive-discrimination training was administered there were reliable differences in favor of groups given differential reinforcement during observing-response training over nondifferentially reinforced groups combined with controls given no prior training, due chiefly to the performance of normal subjects given specific instructions and differential reinforcement during training.

Offenbach, S. I. Studies of children's probability learning behavior: II. Effect of method and event at frequency at two age levels. *Child Development*, 1965, *36*, 951-962.

A probability-learning task in which the stimuli were presented either simultaneously or successively was given to kindergarten and fourth-grade Ss. The more frequent event occurred 60%, 75%, or 90% of the time. The global measures indicated that both age groups responded appropriately to the E^1 frequencies. Effects of the method of stimulus presentation were slight and were found only at the 75% E^1 level. The analyses of intratask behavior indicated that the simultaneous procedure made it easier for both age groups to respond on the basis of previous outcomes. Fourth graders seemed to try to find rules governing the occurrence of the events, while the younger children responded to each event in isolation.

Offenbach, S. I. Reinforcer acquisition in discrimination learning. *Psychological Reports*, 1966, *19*, 843-849.

In an earlier study in which a buzzer sound was combined in pretraining with Right or Wrong, a two-choice discrimination-learning task was presented immediately following pretraining. Children learned that the buzz had meaning (in a direction opposite the verbal statement with which it was combined). In the present experiment, E's silence was examined instead of the buzz. The data indicated that silence, when combined with Right (R) or Wrong (W) in the verbal reinforcement combinations NW and RN, also acquired reinforcement value opposite that of the verbal statement.

Ojemann, R. H., Maxey, E. J., & Snider, B. C. F. Effects of guided learning experiences in developing probability concepts at the 5th grade level. *Perceptual and Motor Skills*, 1965, *21*, 415-427.

Fifth graders were given training designed to develop an understanding of selected probability concepts, while a control group saw two irrelevant films. Four posttests were used. Results indicated significant differences in favor of the experimental Ss, including a test of maximizing success when prior knowledge as to input level was not available and no extraneous rewards were used.

Ojemann, R. H., & Pritchett, K. Piaget and the role of guided experiences in human development. Perceptual and Motor Skills, 1963, 17, 927-940.

A planned program for developing the concept of specific gravity was tested at the kindergarten and first-grade levels. Stage of concept development was measured in individual interviews with the 39 Ss before and after administration of the learning program, which consisted of a 1-hour period on each of three successive days. Results indicated that (a) planned learning programs can affect significantly the development of the concept of specific gravity at this stage level and (b) the administration of a planned learning program can affect the development of stages described by Piaget for a significant proportion of Ss.

Olson, J. L., Hahn, H. R., & Herman, A. L. Psycholinguistic curriculum. Mental Retardation, 1965, 3, No. 2, 14-19.

There is a need for differential emphasis of cognitive areas in constructing curriculum for young retarded children. Case study analyses and test results of children enrolled in a curriculum based upon their linguistic strengths and weaknesses provide information which raises a number of interesting educational questions.

Orpet, R. E., & Meyers, C. E. Six structure-of-intellect hypotheses in six-year-old children. Journal of Educational Psychology, 1966, 57 (6), 341-346.

One-hundred 6-year-old kindergarten children were given a 20-test battery hypothesizing six Guilford structure-of-intellect cells. Principal component factors were given several varimax rotations. Strong factors which appeared were memory for symbolic units (MSU), convergent semantic production, divergent production of semantic units, and evaluation of figural units (EFU) with tentative factor of memory for figural units (MFU). Tests for an evaluation of symbolic units factor loaded on EFU suggest that reaction to visual language symbols is still perceptual at age 6. Separation of MSU from MFU was believed due to visual vs. auditory channels.

Osler, S. F., & Fivel, M. W. Concept attainment: I. The role of age and intelligence in concept attainment by induction. Journal of Experimental Psychology, 1961, 62, 1-8.

> This study attempted to determine the role of intelligence in concept attainment by induction. Concepts studied were bird, animal, and other living things. The age groups chosen, 6, 10 and 14 years, represent the extremes and midpoint of elementary school population and fall within the three stages defined by Piaget. Results: Age and intelligence were found to be associated with effective concept learning but no specific mechanism for enhancement was clarified. Learning curves of children of normal and superior intelligence revealed that superior children were more apt to be sudden learners (function of intelligence) but neither age nor concept hierarchy produced any differences. An association between an intelligence and hypothesis testing was inferred.

Osler, S. F., & Kofsky, E. Stimulus uncertainty as a variable in the development of conceptual ability. Journal of Experimental Child Psychology, 1965, 2, 264-279.

> The effect of age and stimulus complexity on concept attainment and the role of stimulus cues in the solution of concept attainment problems were studied with 270 Ss aged 4, 6, and 8. Ss were divided into 27 experimental groups, constituting a factorial design of 3 ages, three levels of stimulus complexity, and three concepts. The concepts were form, color, and size, presented with none, one, or two, irrelevant stimulus dimensions. Significant age and stimulus complexity effects were obtained; and measures of information transmission showed that criterion Ss were governed primarily by the relevant (reinforced) stimulus dimensions, while the responses of noncriterion Ss were determined significantly by irrelevant stimulus cues and position biases. The total amount of information transmitted by successful Ss correlated positively with age. Total information transmission in the failing group was negatively correlated with age. Older failures did not respond consistently to one cue, while younger children tended to perseverate on irrelevant stimulus dimensions. Differences in information transmission were interpreted as reflecting limitations in memory or variations in strategy.

Osler, S. F., & Shapiro, S. L. Studies in concept attainment: IV. The role of partial reinforcement as a function of age and intelligence. Child Development, 1964, 35, 623-633.

> Children at four age levels between 6 and 14, at average and high intelligence levels, were given an inductive concept attainment

task under conditions of continuous or partial reinforcement. On the basis of the incremental and mediation models of concept attainment, it was predicted that the reinforcement conditions would produce significant interactions with age and intelligence. The results were analyzed in terms of trials and reinforcements to criterion and the number of solvers in each group. Partial reinforcement proved to be relatively more difficult for the older and more intelligent Ss.

Osler, S. F., & Trautman, G. E. Concept attainment: II. Effect of stimulus complexity upon concept attainment at two levels of intelligence. Journal of Experimental Psychology, 1961, 62, 9-13.

The previous interpretation that Ss of superior intelligence attain concepts by testing hypotheses while Ss of normal intelligence attain concepts through S-R associative learning was tested with 120 elementary and junior high-school children. Half solved the task with simple stimuli and half with complex stimuli. The prediction that complex stimuli would generate more hypotheses than simple ones and thus slow down superior Ss, but not affect normal Ss, was confirmed.

Osler, S F., & Weiss, S. R. Studies in concept attainment: III. Effect of instructions at two levels of intelligence. Journal of Experimental Psychology, 1962, 63, 528-533.

A concept attainment task was presented under general and explicit instructions to Ss 6, 10, and 14 years of age, divided into two intelligence groups. Under nonspecific instructions, superior intelligence was associated with more effective concept attainment, while under explicit instructions the average intelligence group improved and those of superior intelligence remained the same. Superior intelligence apparently gave Ss an advantage in the problem-finding phase of the task, but not in actual problem solution. Problem solving ability increases within the age range studied.

Penk, W. E. Developmental changes in children's conceptual behavior. Paper presented at the annual meeting of the American Psychological Association, Chicago, September 1965.

Developmental changes in children's conceptual behavior were investigated within the framework of McGaughran's conceptual area analysis of object sortings. Two commonly observed aspects of growth were clearly demonstrated. First, children reflected increasing enculturative effects. Second, children shifted levels of abstraction as age increased, from global to highly differentiated to hierarchically integrated concepts.

Piaget, J. Judgment and reasoning in the child. New York: Harcourt and Brace, 1928.

The child's concepts are first concrete and tied to his own perceptual experiences. Paralleling this development of objectivity toward the world is the development of subjectivity toward the self and thought. During early stages the child believes that thoughts are words in themselves.

Piaget, J. The Psychology of Intelligence. Patterson, New Jersey: Littlefield and Adams, 1960.

Based on a course given by the author, the subject is covered in eight chapters dealing with the nature of intelligence, sensory-motor functions, and the development of thought. Intelligence is no longer considered a faculty but a state of final equilibrium toward which the successive adaptations of the sensory-motor functions tend, implying mental evolution and functional unity. Intelligence is placed on a biological basis and extricated from its traditional connection with logic. After reviewing the different operations that constitute thought, the relation is shown between these functional totalities.

Piaget, J. The genetic approach to the psychology of thought. Journal of Educational Psychology, 1961, 52, 275-280.

Two forms of thinking are defined--the formal viewpoint, which deals with the configuration of things (perceptions, mental images, etc.) and dynamic thinking, which deals with transformations. Thinking means arriving at the transformations which furnish the reasons for the state of things. The development of thought goes through a gradual subordination of formal into dynamic aspects. Stages in this development are discussed in relation to the development of such abilities as conservation and transitivity of substance, length, etc., and the interaction of the child with his physical and social environment is examined.

Piaget, J. The Origins of Intelligence in Children. New York: International Universities Press, 1962.

An introduction considers the biological problem of intelligence and its growth sequence in six stages is presented: the use of reflexes, the first acquired adaptations to the primary circular reaction, secondary circular reactions and the procedures destined to make interesting sights last, the coordination of the secondary schemata and their applications to new situations, the tertiary circular reaction and the discovery of new means through active experimentation, and the invention of new means through mental combinations.

Piaget, J., & Inhelder, B. Diagnosis of mental operations and theory of intelligence. American Journal of Mental Deficiency, 1947, 51, 401-407.

Criticisms are made of metric scales of intelligence as being insufficient methods of diagnosis of the abnormal child's mental functioning. (1) A test gives results on efficiency of mental activity without grasping the psychological operations in themselves, it provides the sum of successes and failures, which is the actual result of past activities and attainments, but leaves untouched the way in which these have been reached. (2) Mental age, in reference to a scale of average efficiency, does not correspond to any natural phase of mental development. The fact that a child succeeds in any one test does not necessarily imply that he will have succeeded in all those of lower age groups. It is suggested that following a Guttman model, a series of tests be made up such that success in test B could presuppose success in test A, etc.

Poddjakov, N. N. The development of mobility of visual concepts in preschool children. Voprosy Psikhologii, 1965, No. 1, 100-111. (Child Development Abstracts, 1965, 39, 110.)

This study examined the development of preschool children's ability to imagine plane figures in different spatial positions. The results showed that the ability to imagine plane figures in differed spatial positions is underdeveloped in preschool children, and that the children's having correct and stable concepts about a figure do not yet provide the ability to imagine this figure in different spatial positions. The ability to imagine figures in different spatial positions requires certain ways of actualization of these concepts, and certain tactics of actions with the imagined figure, and mobility of a child's concepts (ability to imagine figure in different spatial positions) does not depend often upon the correctness of these concepts. The ability to imagine a figure in different spatial positions, to a significant extent, depends upon the stability of concepts reflecting relationships between parts of this figure.

Pratt, K. C., Hartmann, W. E., & Mead, J. L. Indeterminate number concepts: III. Representation by children through selection of appropriate aggregations. Journal of Genetic Psychology, 1954, 84, 39-63.

> An investigation was made of the discovery of determinate number groups related by children to certain indeterminate number names, as well as the effect of concrete things, or the symbols of concrete things, upon the choice of an aggregate to illustrate any one indeterminate number name.

Prehm, H. J. Retention in retarded and normal children as a function of task difficulty, meaningfulness, and degree of original learning. Journal of Mental Deficiency Research, 1966, 10 (3), 221-229.

> The short- and long-term retention performance of 96 mentally retarded and 96 mentally normal public school children was compared as a function of two levels of meaningfulness, task difficulty, and degree of learning. It was found that even with differences in rate of initial learning considered, the relearning performance of the normal Ss was significantly superior to that of the retarded Ss for both 24-hour and 3-month tests of retention, and 100% overlearning facilitates 24-hour relearning performances, but no 3-month relearning performance. Discrepancies between the present investigation and previous research are discussed, and tentative hypotheses concerning the effect of extended learning, based on the discrepant findings, are proposed (15 references).

Pufall, P. B. Acquisition and generalization of spatial order conservation in young children. Dissertation, Center for Research in Human Learning, University of Minnesota, Minneapolis, Minnesota, 1966.

> In a study to investigate the effect of certain conditions on conservation of spatial order, 45 kindergarten children who had failed to conserve in pretesting were trained on one of three training procedures: "reversibility" training with concrete demonstrations of reversibility and manipulation of order; "reproduction" training emphasizing only manipulation of order; and "concept identification," a sorting task with minimal motor involvement, emphasizing discrimination between "reversed" and other "different" ordering. Results confirmed the prediction that "reversibility" training would induce conservation of spatial order more readily than mere manipulation training or nonmotoric conceptual training.

Pufall, P. B., & Furth, H. G. Recognition and learning of visual sequences in young children. Child Development, 1966, 37 (4) 827-836.

In two studies investigating recognition and learning of visual sequences in children aged 4 to 6, success implied discriminative mastery among sequences composed of identical elements but arranged in different sequential orders. Experiment I showed that 4-year-old children could match sequences and that performance for all ages improved when sequences were perceptually present. In Experiment II on successively presented sequences, no children succeeded at age 4, while at ages 5 and 6 most children succeeded. Errors decreased with age and on simultaneous presentation, a majority at all ages succeeded. The fact that these results occurred even though training had been given suggests that 4-year-old children may not internally construct or maintain sequences without perceptual support. Results are seen as supporting Piaget's position on the development of serial ordering.

Rajalakshmi, R., & Jeeves, M. A. Discrimination learning and reversal learning in children as related to performance on certain WISC items and on the Goodenough draw-a-man test. *Journal of Genetic Psychology*, 1965, *106*, 149-156.

This study investigated the relative efficiency of discrimination learning and reversal learning as measures of learning ability. Results indicate that intelligence, as measured on certain WISC items and on Goodenough's Draw-A-Man Test, is more highly correlated with learning. Discrimination learning scores correlate significantly with intelligence scores at the 5 1/2- to 6-year-old level, but not on an 8-year-old level; while reversal learning scores correlate significantly at both age levels.

Rambusch, N. *Learning how to learn*. Baltimore: Pelican Press, 1962.

This is a discussion on Montessori theory and method in terms of contemporary theories and practices; it is seeking validation by indicating the support current theories give, in part, to different aspects of the Montessori method.

Reese, H. W. Discrimination learning set and perceptual set in young children. *Child Development*, 1965, *36*, 153-161.

In Part I, preschool children were given discrimination learning-set problems (learned to criterion) until a learning-set criterion was attained. Most Ss acquired the learning-set during training on problem 1. In Part II Ss saw Bugelski's rat-man ambiguous figure after the presentation of pictures of people (human-set group) or inanimate objects (control group). Each group included a subgroup of Ss who had just finished the learning-set training and a subgroup of experimentally naive Ss. There was no significant perceptual set effect in either subgroup. Therefore, young children exhibit a deficiency in mediation under some conditions (perceptual set), but not others (learning set).

Reese, H. W. Imagery in paired-associate learning in children. *Journal of Experimental Child Psychology*, 1965, 2, 290-296.

Response items in a paired-associate task were presented verbally and pictorially. Two groups were given verbal descriptions of interactions between the stimulus and response items (verbal compounds), and two groups only the names of the response items. Ss were divided into three age levels with a total range of 36-96 months. Verbal compounds and visual compounds were equally effective, both facilitating performance. It was suggested that verbal description may facilitate learning more than visual imagery (visual compounds), unless S verbalizes descriptions of the images.

Reese, H. W., & Fiero, P. G. Overlearning and transposition. *Child Development*, 1964, *35*, 1361-1365.

Children with a median CA of about 83 months--trained on the intermediate-size problem to a low, moderate, or high criterion--were given a Near and a Far transposition test (in counterbalanced order). Significantly more transposition occurred on the Near test than on the Far test, and overlearning had no significant effect on performance. It was suggested that mediation occurs in young children if it increases the probability of reward, but does not occur when it is irrelevant to reward.

Rieber, M. Verbal mediation in normal and retarded children. *American Journal of Mental Deficiency*, 1964, *68*, 634-641.

Thirty-two retarded children attending special education classes and 32 normal children in second grade were pretrained with a verbal paired-associate task consisting of three S-R pairs. Line drawings and printed words denoting colors were the stimulus and response items. Ss were then presented with a motor paired-associates task involving four stimulus words and four differently colored push-buttons. For three of these S-R pairs, the stimulus items were words that denoted the stimuli used during pretraining response items. In a test for mediation, the response items on two of the S-R pairs were interchanged, one pair remaining the same and a fourth pair introduced as a control. Largest number of errors were made on the switched S-R pair and fewest errors on the original pair. This was taken as evidence that both groups used the responses learned during verbal pretraining as mediators in the subsequent motor learning task.

Robinson, H. B. An experimental examination of the size-weight illusion in young children. Child Development, 1964, 35, 91-107.

In a series of investigations of developmental aspects of the size-weight illusion, almost all 144 Ss, 2-10 years, manifested the illusion after being trained to choose the heavier of two cylinders. Frequency of the illusion was unrelated to age, but its magnitude was greater in younger Ss. For 2-year-old Ss trained in finer weight discriminations, magnitude diminished in proportion to skill. It was suggested that training procedures accounted for discrepancies with previous findings that the illusion increased with age. Findings were consistent with Piaget's general theory of cognitive development, but not his specific notions concerning the illusion (30 references).

Robison, H. F., & Spodek, B. New directions in the kindergarten. Teachers College Press, Columbia University, New York, 1965.

The authors propose a selection of content for a kindergarten curriculum based on the key concepts in the major disciplines. Their research on the teaching of key concepts in history, geography, and economics is described. Other chapters deal with basic concepts in the social sciences and in the physical sciences and mathematics. Teaching practices to facilitate the young child's concept learning are discussed. Needed materials, equipment and experiences are also considered. A chapter is devoted to suggestions for stimulating language growth in the kindergarten program with emphasis on how the teacher herself may make evaluations. Each chapter has references.

Ross, L. E., Hetherington, M., & Wray, N. P. Delay of reward and the learning of a size problem by normal and retarded children. Child Development, 1965, 36, 509-517.

Normal and moderately retarded children were compared on a size-discrimination problem under three delay-of-reward conditions and with the chosen stimulus visible (V) or not (NV) during the delay period. In the study 24 normal and 24 moderately retarded children, matched on MA, were run under 0, 12V, 12NV, 18V, and 18NV conditions (total N=240). The IQ factor was significant under both V and NV conditions, with retardates showing poorer performance; and delay was significant for the V condition but not for the NV condition.

Rossi, E. Development of classificatory behavior. Child Development, 1964, 35, 137-142.

Bousfield's associative clustering method was used to study the development of classificatory behavior. Three groups of children, 5, 8, and 11 years of age respectively, were administered a 20-word stimulus list made up of 5 words from each of four different categories. For half of the subjects at each age level verbal mediating terms were included. No deviation from linearity in the relation between age and clustering was found; nor did the presence of verbal mediators appear to facilitate clustering. The importance of difficulty level of stimulus material for demonstrating both the effectiveness of verbal mediators in clustering and the existence of discriminable developmental stages in classificatory behavior is discussed.

Ruzskaya, A. G. (The role of direct experience and of speech in the concept formation of preschool children) Doklady Akademia Pedagogicheskikh Nauk RSFSR. (Psychological Abstracts, 1961, 35, P 200)

Children aged 3 to 7 were taught to discriminate between various geometrical figures by means of visual presentation and verbal designation of the figures. Verbal factors were particularly important with older children. Formation of the verbal connections with the objects depended upon the orienting-investigatory activity of Ss (some used trial and error, some secondary clues, some the whole outline of the figure). It was concluded that the most important factor in concept formation is the verbal signal.

Sallee, S. J., & Gray, P. H. Failure to confirm Piaget's formulation of number perception in children. Perceptual and Motor Skills, 1963, 17, 586.

Nursery school children were used in two experiments on matching number of objects from sample, the first with the sample visible and the second with the sample shown, then hidden. In both experiments there was a systematic increase in Ss failing to be correct as the number of objects increased. It was the older children who employed one-to-one correspondence; length correspondence was nil, and only three Ss used oral counting in either experiment.

Salmina, H. C. Concept formation in early childhood. Doklady Akademii Pedagogicheskikh Nauk RSFSR, 1960, 4, 63-64. (Psychological Abstracts, 1962, 36, 472)

This study investigated the sequence of the conditions occurring in the development of concepts in groups of 72 nursery school children. By means of toys Ss were trained to form quality, action, and relation concepts. The latter were particularly slow in developing.

Santostefano, S., & Paley, E. Development of cognitive controls in children. *Child Development*, 1964, *35*, 939-949.

Two tests were devised to measure in children two cognitive controls reported as being identifiable in adults. Sixty public school children at three age levels (6, 9, and 12) were given a Circles Test (scanning vs. focusing) and a Fruit-Distraction Test (constricted vs. flexible). The data suggested that these principles operate in children and follow a developmental course. Findings were related to other data in the literature and some theoretical implications for cognitive and the role of experience in the development of individual differences were considered.

Saugstad, P., & Raaheim, K. Problem-solving and availability of functions in children. *Nordisk Psykologi*, 1959, *11*, 45-58. (*Psychological Abstract*, 1960, *34*, 968)

The hypothesis that children below high school age who have available the necessary functions for the solution to a problem will, like high school students, solve the problem. The hypothesis is not sustained except in the case of children close to high school age.

Saugstad, P., & Raaheim, K. Problem-solving, past experience and availability of functions. *British Journal of Psychology*, 1960, *51*, 97-104.

Critical functions of two objects were demonstrated to 20 boys; the correct solution to a ball problem was dependent upon making a nail into a hook and a newspaper into a hollow cylinder. A control group was presented with the problem with no previous demonstration. Nineteen of the experimental group and 10 of the control group solved the problem within the half-hour allowed. It is concluded that a fundamental aspect of problem solving is uncovered by considering the process in terms of the function of concrete objects. The results are related to various experiments on the effects of hints at demonstration on problem solving.

Scott, N. C., Jr. Science concept achievement and cognitive functions. *Journal of Research in Science Teaching*, 1964, *2*, 7-16.

Two-hundred children, aged 10 and 11, were tested for the relationship of Inductive Reasoning and Cognitive Styles in Categorization behavior to Science Concept Achievement. The results indicate that each age level had a unique dependency upon a particular method of assessing cognitive functions--Inductive Reasoning in the 10-year-old age range and Cognitive Styles in

Categorization Behavior in the 11-year-old age range. An interaction between age levels and the variables of this research was found. It was recommended that a comprehensive approach be taken when assessing the cognitive functions of elementary school children.

Semler, I. J., & Iscoe, I. Comparative and developmental study of the learning abilities of negro and white children under four conditions. Journal of Educational Psychology, 1963, 54, 38-44.

Using object pairs and picture pairs of the same objects in conceptually similar and dissimilar sets in four experimental conditions, 135 Negro and 141 white subjects were compared across age levels 5 to 9 years. Fullscale WISC IQs were found to be significantly lower for Negro than for white subjects across all ages but differences in paired associate learning favoring white subjects at lower age levels disappeared by 9 years of age. Racial differences in IQ at the 5-year level were found, as well as negligible correlations between learning-task scores and IQ for both races. The authors caution that "educators should exercise great caution in inferring learning ability from measured intellectual levels alone."

Semler, I. J., & Iscoe, I. Structure of intelligence in Negro and white children. Journal of Educational Psychology, 1966, 57 (6), 326-336.

Performance levels on the WISC and on the Progressive Matrices (PM) and the factorial structures of the WISC were compared for white and Negro children. White Ss had higher WISC Full Scale IQs than Negroes at all age levels and higher PM total scores at the 7-year level, but not at the 8- and 9-year levels. While the white and Negro WISC intercorrelation matrices appeared to be similar, a multivariate analysis of variance showed heterogeneous dispersions and mean vectors. Since the multivariate analysis indicated statistically dissimilar WISC structures for the white and Negro samples, separate factor analyses were computed to explore the nature of the differences. The PM intercorrelation matrices for whites and Negroes were highly similar.

Setterington, R., & Walters, R. Effects of concurrent delays of material rewards and punishments on problem-solving in children. Child Development, 1964, 35, 275-280.

Second-grade children were randomly assigned to one of nine conditions in a study of the effects of concurrent delay of reward and delay of punishment on problem solving. Three levels of delay of reward and three levels of delay of punishment were selected for study. Increasing delay of reward significantly increased both the number of trials required for mastering the task and the number of errors made during learning. No significant differences in delay of punishment, however, were produced.

Shantz, C. U., & Smock, C. D. Development of distance conservation and the spatial coordinate system. Child Development, 1966, 37 (4), 943-948.

In an investigation with 20 first graders, two spatial concepts, conservation of distance and the Euclidean coordinate system were studied to test Piaget's hypothesis that distance conservation is a prerequisite achievement of the coordinate concept. Drawings and objects as test stimuli were compared for possible differential effects on performance. Data were generally supportive of the developmental priority of conservation of distance to a Euclidean coordinate system. Presentation of tasks using objects before drawings, in contrast to the reverse order, tended to facilitate correct responses.

Shepard, W. O. Learning set in preschool children. Journal of Comparative and Physiological Psychology, 1957, 50, 15-17.

Twenty preschool children were presented, on one day, with six conditional space discrimination problems. A marked improvement in performance occurred from the first to the second task, followed by a slight decline, which was attributed to boredom.

Shepard, W. O., & Schaeffer, M. The effect of concept knowledge on discrimination learning. Child Development, 1956, 27, 173-178.

The effect of concept name knowledge on learning in sixth-grade children was studied using a group technique. The task involved choosing the triangle on every trial from among four geometric figures. Children who had demonstrated on a concept name test that they could consistently and correctly use the word "triangle" were found to perform better on the learning task than those who could not. Results were discussed in terms of the mediated generalization hypothesis.

Siegel, A. W., & Stevenson, H. W. Incidental learning - a developmental study. Child Development, 1966, 37 (4), 811-817.

Ninety-six children between 7 and 14 years and 24 adults studied incidental learning. An initial three-choice successive discrimination task was followed by a series of trials in which each discriminative stimulus was presented in a stimulus complex with three additional objects. The number of incidental objects to which S responded correctly on a third series of trials was used as a measure of incidental learning. A significant increase in incidental learning was found between ages 7-8 and 11-12, and a significant decrease between ages 11-12 and 13-14. Adults performed at a higher level than any of the children.

Sigel, I. E. Developmental trends in the abstraction ability of children. *Child Development*, 1953, *24*, 131-144.

A study with 60 children (7-11 years) showed abstraction on a sensory-motor level increasing with age, while perceptual classification of items was shown to decrease with age.

Sigel, I. E. The dominance of meaning. *Journal of Genetic Psychology*, 1954, *85*, 201-207.

Instructions to children to classify material on the basis of similarity or belongingness yielded classifications mainly on the basis of meaning of the objects rather than on stimulus characteristics. This effect was referred to by the author as "meaning dominance."

Sigel, I. E., Anderson, L. M., & Shapiro, H. Categorization behavior of lower and middle class Negro preschool children: Differences in dealing with representation of familiar objects. Paper presented at the biennial meeting of the Society for Research in Child Development, Minneapolis, March 1965.

Two groups of preschool children, one disadvantaged and one middle class, were given three sorting tasks in varied modes of presentation with actual objects, colored pictures and black and white pictures (life-size). Middle-class children gave more objective responses, classifying on the basis of physical properties; while lower-class children classified subjectively according to function. Middle-class children were better than lower-class children at sorting the pictures as opposed to the objects themselves. Implications for education are discussed.

Sigel, I. E., & Mermelstein, E. Effects of nonschooling on Piagetian tasks of conservation. Paper presented at the annual meeting of the American Psychological Association, September 1965.

A study with 120 Negro children, aged 6 to 9, who had no formal schooling for three years prior to the testing, examined the effects of non-schooling on (1) conservation of continuous and discontinuous quantity--substance, weight and volume; (2) the role of verbalization in conservation tasks; (3) stages of development of conservation and (4) effect of perceptual discrepancies on the relationship between conservation of quantity and conservation. Results indicated no effect on non-schooling on conservation and affirmed the existence of stages as reported by Piaget.

Sigel, I. E., Roeper, A., & Hooper, F. H. A training procedure for acquisition of Piaget's conservation of quantity - a pilot study and its replications. *British Journal of Educational Psychology*, 1966, *36*, (3), 301-311.

This study investigated the relationship between logical, prerequisite operations, and Piaget's conservation tasks. Special training was given on multiple classification, multiple relations and reversibility as a means of inducing conservation acquisition or improvement. Twenty children between ages 4.3 and 5, IQ's over 130, were assigned to training and control groups. Ten Ss made up a pilot study and 10 constituted a replication sample. Posttesting showed clear differences between the training and control Ss, and the training Ss performances indicated a greater awareness of relevant attributes and increased verbal sophistication within the test situation.

Smedslund, J. The acquisition of conservation of substance and weight in children: I-VII. *Scandinavian Journal of Psychology*, 1961, *2*, 11-20, 71-87, 153-160, 203-210, & 1962, *3*, 69-77.

The issue of external reinforcement vs. inner equilibration (Piaget) was the focus for a series of studies on acquisition of conservation of substance and weight. Among the findings three types of external reinforcement training produced no differences between experimental groups, suggesting that the training had not induced conservation in any groups. Conservation of weight was more easily extinguished in Ss who had reinforcement training than in Ss who had acquired it normally prior to the study; an attempt to force Ss to become less perception-bound (equated with non-conservation) by making visual cues artificially unreliable, and thus induce conservation, failed; results of exposing Ss to situations of cognitive conflict appeared to support the theory of acquisition of conservation by inner equilibration induced by conflict; conflict training with no external reinforcement was more successful with discontinuous than continuous material; and the data obtained on addition and subtraction problems strengthened the hypothesis that conservation represents complete reversibility of the plus and minus operation.

Smedslund, J. Development of concrete transitivity of length in children. Child Development, 1963, 34, 389-405.

Braine reports that transitivity of length occurs more than 2 years earlier than assumed by Piaget. Braine's technique, in addition to other weaknesses, fails to control for the possibility of simple nontransitive hypotheses based on learning. Data obtained with a new test, designed to meet all major methodological requirements, supports Piaget against Braine that the average age of acquisition of transitivity of length probably lies near 8-0.

Smedslund, J. The effect of observation on children's representation of the spatial orientation of a water surface. Journal of Genetic Psychology, 1963, 102, 195-201.

Children aged 5 to 7 were shown pictures of bottles tilted in various ways, and asked to draw the water surface in each bottle (pretest). Then a flat bottle half-filled with ink-water was presented and was tilted in various ways. The pretest was repeated and the children were also asked to choose the correct picture in several sets of drawn model-pictures. Pretest results show absence of an adequate conception of the spatial orientation of the water surface and no effects from the period of observation in Ss who had no trace of an adequate conception in the pretest. The results were interpreted within the framework of Piaget's theory.

Smedslund, J. Patterns of experience and the acquisition of concrete transitivity of weight in eight-year-old children. Scandinavian Journal of Psychology, 1963, 4 (4), 251-256.

Empirical control vs. no empirical control and fixed vs. free procedure were not found to affect the acquisition of transitivity. The fixed procedure involved practice on the sequences, whereas the free procedure merely required the children to order triads of objects according to weight. It is concluded that empirical control is unimportant. The lack of effect of free vs. fixed procedure is contrary to some earlier findings with younger children, who profited only from a free procedure.

Smedslund, J. Patterns of experience and the acquisition of a conservation of length. Scandinavian Journal of Psychology, 1963, 4, (4), 257-264.

> The effects of five procedures on the acquisition of conservation of length were studied. A Muller-Lyer illusion was used to induce apparent changes in length in the test and practice situations. Two procedures involved practice on addition-subtraction, one a progressive increase in the strength of the Muller-Lyer illusion and the other anticipation of the outcome of displacements of the objects with the fifth procedure a composite of the other four. All groups had some acquisitions, with highest frequency in the anticipation group and lowest in the increase-in-illusion group.

Smedslund, J. Concrete reasoning: A study of intellectual development. Psychological Monographs, 1964, 29, (2, Whole No. 93).

> Ss aged 4.3 to 11.4 were tested in situations designed to measure their "concrete Intelligence" (Piaget) in an attempt to determine the relationship between scores on various types of items. Comparison of results on the four major items showed low homogeneity for the set, which was thought to indicate limited generality of concrete reasoning during period of acquisition. Conservation and transitivity of length, multiplication of classes and of relations appear to attain simultaneously, but there were numerous exceptions. Conservation appears to precede transitivity and no consistent relationship between conservation and the addition-subtraction operation appeared. It was concluded that the present study failed to control for variations in goal objects and perception from one item to the other. The need for methodological development is noted.

Smedslund, J. The development of transitivity of length: A comment on Braine's reply. Child Development, 1965, 36, 577-580.

> It is argued that Braine's data on pseudomeasurement are not adequately presented in this report, that they are ambiguous, and that his interpretations are therefore unwarranted. It is maintained that whether or not Braine has demonstrated genuine transitivity of length on 5-year-old children has not been determined as yet. A footnote by Braine is included.

Smedslund, J. Performance on measurement and pseudomeasurement tasks by five- to seven-year-old children. Psychological Abstracts, 1966, 40, (10), 1035.

Ss who had been previously trained by a nonverbal reinforcement method to select the longer one of a pair of sticks were given two genuine (G) measurement and two pseudomeasurement (P) tests. The first P test involved the use of two measuring sticks, clearly different in length, and the second test, addition or subtraction of a piece of the measuring stick between measurements. The fact that a single factor seemed to generate much of the performance in all four tests suggested that, since the P tasks had to be solved by means of nontransitive inferences, the G tasks were solved in the same way. It is concluded that non-verbal reinforcement methods may not yield a valid diagnosis of transitivity.

Smilansky, M., & Smilansky, S. Bases for intellectual advancement of culturally disadvantaged children. Revision of a paper presented at the 7th Annual Research Roundup of Children and Youth, University of California, Los Angeles, July 1965.

A program showing ways to use a year of kindergarten to promote cognitive abilities, impart basic information and modify attitudes essential for scholastic success of culturally deprived children in their first two years of school is reported in progress. Regular teachers and normal class size of 35 children were used, but experimental teachers were assisted and given some materials by specialists. After the kindergarten year, the experimental groups were significantly higher than the controls on the Stanford Binet and WISC intelligence tests. An average of a 6-point difference on the S-B and a 10-point difference on the WISC were reported in favor of the experimental groups. The lower the initial IQ of the child, the greater the gain over the year, but all experimental-group children showed some gain, even those starting with above average IQs.

Smith, D. B., & Roth, R. M. Problem-solving behavior of preschool children in a spontaneous setting. Journal of Genetic Psychology, 1960, 97, 129-143.

The performance of preschool children in spontaneous problem solving is related more to chronological age than to mental age. The hypothesis that performance on mental tests reflects an experiential factor rather than genuine differences in intellectual ability was supported.

Smith, M. D., & Bolyard, A. J. Interaction of words and nonwordal stimuli in programmed sequences of concept formation tasts. AV Communication Review, 1966, 14, (4), 514-531.

Two versions of a learning program on mathematics, one entirely wordless and one including relevant verbal tasks, were tested on matched groups of fifth and sixth graders. Words appeared to enhance learning early in the program but nonwordal stimuli seemed more effective in later stages.

Spiker, C. C., Gerjuoy, I. R., & Shepard, W. O. Children's concept of middle-sizedness and performance on the intermediate size problem. Journal of Comparative and Physiological Psychology, 1956, 49, 416-419.

The hypothe[illegible] that the learning of a discrimination problem involving [illegible]ion of the intermediate size of three stimuli where the absolute size varies from trial to trial is facilitated by Ss' possession of the verbal concept middle-sized was tested. It was found that an understanding of the concept of middle-sizedness facilitated learning of the relational task more than it did the learning of the nonrelational task.

Spiker, C. C., & Lubker, B. J. The relative difficulty for children of the successive and simultaneous discrimination problems. Child Development, 1965, 36, 1091-1101.

This study attempted to (a) determine whether children from 8-11 years of age can learn a successive discrimination problem when the stimulus and response loci are the same, (b) compare the relative difficulty of successive (Su) discrimination problem and simultaneous (Si) problems, (c) determine the effect of nonspatial stimulus similarity (brightness) on the relative difficulties of Su and Si problems, and (d) determine the effect of spatial stimulus similarity (distance between right and left stimuli) on the relative difficulties of these two tasks. The results showed that children of these ages can learn the Su problem. Analyses of the number of trials to criterion and number of correct responses both indicated that the Su problem was significantly more difficult than the Si problem.

Stafford, R. W. The effects of creativity and intelligence on information seeking strategies used in a problem solving task by sixth grade boys. Dissertation Abstracts, 1966, 27, 973.

The effects of intelligence and creativity on information seeking strategies used by 48 sixth-grade males in solving the Twenty Question game were investigated. Intelligence was measured by the Otis Quick-Scoring Mental Ability Test, and creativity was measured by the Minnesota Tests of Creative Thinking. An analysis of the strategies used by the Ss in solving the Twenty

Questions game produced an idealized dichotomy--(1) constraint seeking and (2) hypothesis scanning. The subjects selected strategies ranging from the exclusive use of hypothesis scanning to the exclusive use of constraint seeking.

Stern, C. Effect of different verbal instructions and arrangement of materials in identification of concepts. U. S. Office of Education, Cooperative Research Project No. 1684, University of California, Los Angeles, 1963.

In a study to determine the effects of type of visual cues, sequence of presentation, and type of instructions upon kindergarten Ss' identification of mathematical concepts, 132 children were divided into seven treatments: class cue, general cue, strategy cue (ordered), strategy cue (random), no help (ordered), no help (random), and control. In 12-minute training sessions consisting of 48 slides, Ss were presented with four problems (color, size, number, and shape) and training lasted four days. The class cue group was significantly better than the general cue group on the immediate learning test. Random vs. ordered presentation of visual materials produced no significant differences, with the no-help group doing poorest as a whole. No significant trends appeared on "transfer measure." In a replication study to revise the N no sequential differences could be attributed to ordering of pictured stimuli or type of instructions, and it was felt that the meaningfulness of the concepts was not strongly enough established with kindergarten children to permit any concept identification and problem solving with these concepts.

Stern, C. Labeling and variety of concept identification learning of young children. Journal of Educational Psychology, 1965, 56, (5), 235-240.

In a study of labeling and variety effects, 140 first-grade and 137 kindergarten children in six treatment groups rehearsed either concept or instance labels using eight concepts with 3 instances, four concepts with 6 instances, or two concepts with 12 instances. Kindergarten children rehearsing concept rather than instance labels received dependably superior scores in learning but not in transfer tests. First-grade children were superior in both learning and transfer under concept-rehearsal conditions. Variety also produced significant differences at both age levels on learning tests. Intermediate variety (four concepts) facilitated transfer to new instances and new concepts for older children. The two-concept, 12-instances condition was least effective.

Stern, C. Children's use of knowledge of results in thinking. U.S. Office of Health, Education, and Welfare, Cooperative Research Project No. 2477, 1966.

A series of studies with third graders investigated the effects of multiple hypotheses and single hypothesis strategies, and random or self-iniated strategies upon the problem solving of children of higher and lower MA's, as well as the effects of overt verbalizing of rules on solutions on the acquisition of either of the two strategies. Instruction in problem solving involving discovery of a rule was more effective than practice with no instruction with self-taught Ss forgetting quicker than instructed Ss, and being less able to generalize to new problems. Higher MA's benefited more from the Multiple Hypotheses strategy instruction than lower MA Ss. It is felt that a scientific attitude toward information getting and processing should be developed as part of the grade school curriculum.

Stern, C., & Kassorla, I. Concept learning of young children as a function of organized or random presentation of instances. Paper presented at the annual meeting of the California Educational Research Association, Los Angeles, March 1967.

Seventy-five disadvantaged Negro children, aged 37 to 66 months, were given one of two versions of a learning program on basic concepts such as clothing and transportation. Both versions contained the same items, one in a structured order and the other in random order. Results showed no significant differences in the effectiveness of the two versions, with both experimental groups scoring significantly higher than a control group on immediate posttests and retention tests.

Stern, C., & Keislar, E. R. Acquisition by young children of strategies for concept identification problems. *Proceedings of the 73rd annual convention of the American Psychological Association*, 1965, 321-322.

Four groups of third-grade children given different 6-day instructional programs in concept-identification problems involving four concepts, differed reliably in post-test performance. The group taught the strategy of testing one hypothesis at a time was significantly superior to children given equal amount of practice with no special training as well as those given task familiarization only. Children taught to test several hypotheses at one time were not found to differ reliably from these groups. Eight- and 9-year-old children can be taught a hypothesis-testing strategy for the solution of concept-identification problems.

Stern, C., & Keislar, E. R. Acquisition of problem solving strategies by young children, and its relation to mental age. *American Educational Research Journal*, 1967, *4*, 1-2.

Four groups of third-grade children given instructional programs in concept identification differed reliably in their posttest performance. The group taught the strategy of testing one hypothesis at a time was significantly superior to all other groups. The group taught the Multiple Hypothesis testing strategy was not reliably different from either the Practiced Control or the Control group. A significant correlation existed for successful performance with the Multiple Hypothesis strategy and mental age. It was concluded that most 8- and 9-year-old children can be taught a simple hypothesis testing strategy for the solution of concept identification problems, and that a more efficient multiple-hypothesis testing strategy can be taught to children who are more mentally mature.

Stevenson, H. W. Learning of complex problems by normal and retarded subjects. *American Journal of Mental Deficiency*, 1960, *64*, 1021-1026.

In a task involving a series of two-choice object discriminations and another task involving a pattern discrimination, no significant differences in learning speed between the two groups were found.

Stevenson, H. W., & Bitterman, M. E. The distance-effect in the transposition of intermediate size by children. *American Journal of Psychology*, 1955, *68*, 274-279.

As a test of relational vs. nonrelational interpretations of transposition, 24 Ss 4 to 6 years old were trained to select the intermediate of three objects differing in size. They were then given two other sets, one of 5 steps removed from the training set. Ss transposed to the near but not to the far set. The results cannot be explained in terms of either theory alone. An explanation is offered in terms of two relational processes - one that is abstract and one that is more closely bound up with the absolute properties of specific situations.

Stevenson, H. W., & Odom, R. D. The relation of anxiety to children's performance on learning and problem solving tasks. *Child Development*, 1965, *36*, 1003-1012.

Boys and girls in grades 4 and 6, a total of 318 Ss, were presented with paired associates, concrete discrimination, abstract discrimination, concept formation, and anagrams tasks. Data were available from intelligence and achievement tests, teachers'

ratings of children's general learning ability and socioeconomic status of the families. The Test Anxiety Scale and Defensiveness Scale were given to all Ss. Significant negative correlations were found between level of anxiety and performance on paired associates and anagrams, and for grade 4 boys on the concept-formation task. Verbal IQ, but not performance IQ, tended to be correlated negatively with anxiety level. Teachers' ratings and achievement-test scores were also generally negatively related to anxiety level. It is concluded that anxiety has the most disruptive effect on performance in tasks involving verbal processes.

Stott, L. H., & Bali, R. S. Infant and preschool mental tests: Review and evaluation. Monograph of the Society for Research in Child Development, 1965, 30, (3).

This project attempted to investigate and evaluate the present total infant and preschool mental testing situation, and to identify some of the current needs. Three approaches were made: (1) A review of the psychological literature dealing with the theoretical thinking which underlay test development and with the uses made of them. (2) A questionnaire survey was made of the current uses of these tests and of the opinions regarding their effectiveness and what might be done to improve the situation. (3) Factor analyses of the test protocols of 1926 infants and young children were made to determine the meaning content of the different tests at specific age levels. Among the findings were: (a) the different scales vary widely in factor content; (b) the pattern of factor content of a test scale at different age levels is different; (c) only the infant tests had items related to "creativity;" (d) the mental-factor meaning of a test item is not necessarily related to its material content. Motor manipulation items may be effective indicators of cognitive functioning.

Strauss, A. L., & Schuessler, K. Socialization, logical reasoning and concept development in the child. American Sociological Review, 1951, 16, 514-523.

This represents the second report of a study of children's concept development considering (1) class differences among children, (2) methodological problems in the application of scale analysis, (3) the cumulative nature of conceptual development, and (4) the disparity between child and adult reasoning and perception.

Strong, P. N., Jr. Comparative studies in simple oddity learning: II. Children, adults and seniles. Psychonomic Science, 1966, 6, (10), 459-460.

> Ss from the age of 3.0 to hospitalized senile were run on identical one-trial, two-position oddity problems used previously with cats, raccoons, monkeys, and chimpanzees. There was a total of 113 Ss. The youngest child to learn was 3 years, 4 months of age. Sixty-four per cent of the 6-year-olds learned while all 12-year-olds and college students reached criterion performance with the second day. Some seniles learned the problem but showed atypical, insight-like, learning curves.

Strubing, H. F. The effect of perceptual training upon the discrimination of relativity of position and motion in primary school children. Paper presented at the annual meeting of the American Educational Research Association, New York, 1967.

> The effects of prior exposure to (a) the Frostig Program unit on Perception of Spatial Relationships, or to (b) the Frostig Program unit on Visual Motor Coordination on second grader's learning from The Science Curriculum Improvement Study unit on Relativity of Position and Motion was measured in this study. Both the Spatial Relationship group and the Visual Motor group scored higher on the Relativity unit than untrained central groups, indicating that both specific and nonspecific transfer may be obtained by exposure to perceptual training.

Suchman, J. R., & Aschner, M. J. M. Perceptual and cognitive development. Review of Educational Research, 1961, 31 (5), 451-462.

> There has been increasing interest in the effects of central and intervening processes on the act of perceiving. The construction of theories and models of perceptual mediation has not been matched by empirical research, however, and a number of hypotheses are still in need of adequate testing. Developmental studies of form perception have usually found that common objects are perceived and discriminated more readily by young children than are Euclidian shapes. The act of making social judgments involves more than simple perceptual discriminations. J. P. Guilford and his associates' tests tap such factors in creativity as ideational fluency, spontaneous flexibility, and originality. The most recent studies on the growth of particular concepts reflect Piaget's influence.

Suppes, P. Modern learning theory and the elementary school curriculum. American Educational Research Journal, 1964, 1, 79-93.

The implications of recent research in learning theory for the development of elementary school curriculum are discussed in relation to modern computer technology. Studies on individual differences, immediate reinforcement and overt correction procedures, transfer, grouping of stimuli, and response latency are summarized and a detailed description of the possibilities of computer-based laboratory instruction is given.

Suppes, P. Mathematical concept formation in children. American Psychologist, 1966, 21, 139-150.

Four major topics are treated: (1) all-or-none conditioning processes in simple concept formation, (2) some results concerning transfer, (3) geometric invariants of perceptual space, and (4) mechanisms of concept formation. Several studies were designed to probe the limits of mathematics learning in the classroom for elementary school children of various ages. The search for a detailed algebra of concepts to provide explicit and definite mechanisms for generating new concepts out of old ones may in many situations, perhaps particularly with children, be a mistaken venture. With the exception of a few salient features, new concepts may be formed by random choices, with new concepts being recognized only after one or more instances of the concept have been reached or put together by accident or chance.

Suppes, P., Binford, F. Experimental teaching for mathematical logic in the elementary school. The Arithmetic Teacher, March 1965.

An enrichment program for fifth- and sixth-grade students to develop capacity to do deduction proofs and to test transfer of skills in analysis and correct reasoning to other subject areas, such as arithmetic, reading, and English is described. It was found that upper quartile could achieve 85-90 per cent mastery compared to comparable university students. Some carry-over in critical thinking and attitude into other fields, especially arithmetic, reading, and English, was found, and teacher evaluation was positive.

Suppes, P., & Ginsberg, R. Application of a stimulus sampling model to children's concept formation with and without overt correction responses. Journal of Experimental Psychology, 1962, 63, 330-336.

Fifth- and sixth-grade children learned two concepts in the binary number system, each concept represented by three different stimuli, using either a correction (c) or noncorrection (nc) procedure.

Group nc performed less well than Group c. Both a paired-associate analysis and a pure-property analysis, in which all stimuli describing a single concept were treated as identical items, were employed.

Suppes, P., & Ginsberg, R. Experimental studies of mathematical concept formation in young children. Science Education, 1962, 46, 230-240.

Kindergarten children and first graders were given training in mathematical concepts. Results showed: 1) Ss who were required to respond correctly to all stimuli learned more, 2) incidental learning was not a significant factor, 3) conditions designed to focus attention of Ss on stimuli increased learning, 4) practice in concept identification was more effective in inducing transfer than discrimination between concepts, 5) the 3-choice rather than the 2-choice response situation produced more learning and, 6) prior training on concepts did not transfer to related concepts.

Suppes, P., & Ginsberg, R. A fundamental property of all-or-none models, binomial distribution of responses prior to conditioning, with application to concept formation in children. Psychological Review, 1963, 70, 139-161.

Four implications of the basic assumption of the simple all-or-none conditioning model is that the probability of a correct response remains constant over trials before conditioning: (a) prior to the last error there will be no evidence of learning, (b) the sequence of responses prior to the last error forms a sequence of Bernoulli trials, (c) responses prior to the last error exhibit a binomial distribution, and (d) specific sequences of errors and successes are distributed in accordance with the binomial hypothesis. These four tests were performed on the data from seven experiments concerned with concept formation in children, paired-associate learning and probability learning in adults, and T-maze learning in rats, provided substantial support of the all-or-none model, but when Vincent curves were constructed for responses prior to the last error, some of the learning curves showed significant departures from stationariness.

Suppes, P., & Hill, S. Set theory in the primary grades. Mathematics Teachers Journal, 1963, 13, No. 2.

A new mathematics curriculum for kindergarten through grade 6 which stresses structure and foundations was developed and tested. Branches of mathematics other than arithmetic were included and the central concept is that of set rather than number. Standardized test results indicated that the children using the set and numbers materials scored at least as well on the traditional content as children who had been in traditional programs. In addition, a considerable body of content not tested by standardized tests was taught.

Tanaka, M. N. Classification skills in 1st grade children: The effects of different instructional methods. Paper presented at the annual meeting of the American Educational Research Association, Chicago, February, 1968.

The effects of two instructional strategies (object manipulation and picture verbalization) on the facilitation of classification skills in first-grade children were investigated. It was hypothesized that "manipulation" treatment would be more effective with the lower ability Ss and "verbalization" method with the higher ability Ss. The manipulation treatment increased scores in all ranges of ability while the verbalization treatment was very effective with only the high ability Ss.

Tanaka, M., Campbell, J. T., & Helmick, J. S. Piaget for first grade teachers: written exercises for assessing intellectual development. Paper presented at the annual meeting of the American Educational Research Association, Chicago, February, 1966.

A set of five exercises intended as a culture-free measure of level of development of mental abilities of children entering first grade is described. The five areas tested are labeled: Shapes and Forms, Spatial Relations, Time Concepts, Communications Skills, Mathematical Understanding, and Logical Reasoning. Preliminary trails indicate that the level of difficulty is appropriate, and response from the children being tested has been positive.

Taylor, D. W., & McNemar, O. W. Problem solving and thinking. *Annual Review of Psychology*, 1955, *6*, 455-482.

A survey of literature concerned with problem-solving by normal adult humans, individually and in groups, between 1949 and 1954, is reported. Considerations of set, rigidity, functional fixedness, relation of set to other variables, set and learning theory are covered. However, no studies with young children are reported.

Terrell, G., Jr. The role of incentive in discrimination learning in children. Child Development, 1958, 29, 231-236.

> Differences in the effectiveness of a token incentive, a promised reward, and immediate reward were investigated in a study with groups of children aged 4, 5, 8, and 9. Ss were measured on the learning and transposition of a button pushing response to a size discrimination task. The "promise" group required significantly more trials to learn the concept than did all of the other groups.

Terrell, G., Jr., Durkin, K., & Wiesley, M. Social class and the nature of the incentive in discrimination learning. Journal of Abnormal and Social Psychology, 1959, 59, 270-272.

> This study tested the hypothesis that a non-material incentive is as effective as a material incentive for middle-class pupils, while for lower-class pupils a material incentive is more effective than a non-material one. Twelve Ss in each of the age categories 5, 6, 10, and 11, were asked to respond to geometric figures according to a specific criterion, with one group receiving a light flash as feedback and the other group a piece of candy in addition. Warner's Index of Status Characteristics was used to determine class position. Middle-class children learned more quickly when given a non-material incentive than when given a material incentive, while the reverse was true of lower-class children.

Thomas, E. C. The conceptualization process in advantaged and disadvantaged kindergarten children. Dissertation Abstracts, 1966, 27, 682-683.

> This study examined the conceptualization of advantaged and disadvantaged kindergarten children as demonstrated by their performance on an object sorting test to ascertain the extent to which the process necessary for classificatory behavior is operative in the disadvantaged group and to examine the qualitative differences between the performances of the two groups. Results seemed to indicate that irreparable damage had not yet occurred for the children in the disadvantaged group, suggesting that training may still be fruitful.

Trabasso, T., Deutsch, J. A., & Gelman, R. Attention in discrimination learning of young children. Journal of Experimental Child Psychology, 1966, 4, 9-19.

The separate effects of attention to the relevant dimension and instrumental responses to dimensional values on the learning rates of discrimination shifts by 4-year-old children was investigated. In Experiment I, in which patterns served as stimuli, the reversal was slower than either of the other shifts which were learned about equally fast. In Experiment II, in which objects served as stimuli, the intradimensional shift was faster than either of the others which were learned at about the same rate. Results indicate that transfer of an observing or attentional response to the relevant dimension occurred for objects but not for patterns. Although such attention transferred, it was not sufficient to overcome the effects of original instrumental learning on the reversal problem. The findings are discussed in relation to two-stage theories of discrimination learning which treat attention and prior instrumental learning as separate factors and mediational theory which tends to identify responding to the relevant dimension as mediation.

Turnure, J., & Zigler, E. Outer-directedness in the problem solving of normal and retarded children. *Journal of Abnormal and Social Psychology*, 1964, *69*, 427-436.

Two studies were conducted to test the hypothesis that the high incidence of failure experienced by retardates results in their employing an outer-directed style of problem solving. In Study I, which compared performances after success or failure, retardates were found to be more imitative than normals, and all the children were found to be more imitative following the failure than the success condition. In Study II, E engaged in certain behaviors that if attended to would interfere with S's performance on the first object-assembly task and facilitate performance on the second object-assembly task, and which would provide S with a response that could be imitated on the block-board game. As predicted, the retarded experimental group did worse than the normal experimental group on the first object-assembly task, but was superior to the normals on the second object-assembly task. They also showed a tendency to be more imitative on the block-board game, and made more glances toward E.

Tyler, B. B. Expectancy for eventual success as a factor in problem solving behavior. *Journal of Educational Psychology*, 1958, *49*, 166-172.

This study investigated the effect of "situational" expectancy for eventual success in a problem solving situation on performance. Findings indicated that: (a) differential performance resulted from establishing a "situational" expectancy for eventual success or failure, (b) encouragement and no comments (control) were both superior to discourgement and to intermittent encouragement and discouragement, (c) significantly more Ss in the low expectancy group attempted to memorize a solution to the problem in contrast to working out a logical solution, and, (d) there is an inverse relationship between an expectancy for immediate positive reinforcement and the decision time required for making a response.

Uhr, L. (Ed.) *Pattern recognition - theory, experiment, computer simulations and dynamic models of form perception and discovery*. New York: Wiley, 1966.

The papers included fall into five areas: psychology and philosophy of perception and discovery, integrations of experimental findings, theoretical developments, experimental results from neurophysiology and psychology pertinent to model building, and computer simulations of complex models.

Usova, A. P. (The pedagogy of games and its urgent problems.) *Soviet Education*, 1963, *5*, 29-34.

The article indicates a return to Froebel's use of games as didactic and instructional and favors the use of games to develop personality and "train" to line of thought and behavior.

Van de Geer, J. P., & Jaspars, J. M. F. Cognitive functions. *Annual Review of Psychology*, 1966, *17*, 145-176.

Theoretical problems in defining the meaning of "cognition" are noted, and discussion of relevant literature is limited to the areas of concepts, problem-solving and thought processes on computer simulation of thought and reasoning.

Van Parreren, C. F. (A viewpoint in theory and experimentation on human learning and thinking.) *Acta Psychologica*, 1954, *10*, 351-380. (*Psychological Abstracts*, 1955, *29*, 647)

Research suggests that thinking is not so much inadequate as one-sided. The principle of stratiformity can be applied to autonomous (involuntary and perceptual) as well as intentional thinking and learning. Motivation, mind-set, Gestalt principles, the work of Thorndike, Heidbreder, Selz, Ach, and De Groot's studies in phase-thinking (as in chess) are reviewed.

Vaughter, R. M., & Cross, H. A. Discrimination reversal performance in children as a function of prereversal experience and overlearning. *Psychonomic Science*, 1965, *2*, 363-364.

Ss aged 4 to 5 were given discrimination reversal (DR) training in which variables were number of acquisition trials and type of prereversal experience (PRE). Each DR problem contained 6 or 18 initial discrimination trials and one of four single-object, information-trial conditions: none (NO), positive (P), negative (N), and mixed (M). M experience benefited S more than NO, P, or N. P experience was superior to both NO or N. There was no difference in DR performance under No and N conditions. DR proved more difficult as initial acquisition length increased.

Vinacke, W. E. Concept formation in children of school ages. Education, 1954, 74, 527-534.

A large proportion of studies in concept formation center around language development of children. Although concepts can be studied from their effects, inferences can be drawn about their structural and functional characteristics. Some questions on concept formation are considered: (1) Is there a conceptualizing ability? (2) What concepts does a child possess at various ages? (3) How does a child learn a particular concept? (4) What, in particular, are the characteristics of children's concepts?

Walk, R. D., & Saltz, E. J. Discrimination learning with varying numbers of positive and negative stimuli by children of different ages. Psychonomic Science, 1965, 2, 95-96.

Children aged 5, 6, and 8 were given a two-choice discrimination task with either (1) one positive stimulus and two or three negative stimuli (only one of which was used at a time) or (2) two or three positive stimuli and one negative stimulus. Younger children had as many solutions on each type of task while, the older Ss were successful only with a single positive stimulus and multiple negative stimuli.

Wallach, M. A., & Kogan, N. Modes of thinking in young children. New York: Holt, Rinehart and Winston, 1965.

Creativity and intelligence are considered as "orthogonal modes of thinking whose joint effects are felt in many areas of psychological functioning." Earlier studies are reviewed; and the research tool which enabled the authors to isolate a dimension of creativity, which is independent of the conventional idea of general intelligence, is described. A series of highly intercorrelated creativity tests which did not correlate significantly with intelligence tests were administered to 151 Ss, along with a battery of intelligence tests. Children were rated on behavior in the school environment and tested on styles and strategies of conceptualization and categorization, sensitivity to physiognomic properties of the environment, anxiety, and defensiveness. The relation of creativity and intelligence to the psychological variables is treated as correlational, and direction of causation is not considered. Some implications of this work in the areas of education and research on children's thinking is discussed.

Weaver, E. K., & Coleman, S. Relationship of certain science concepts to mental ability and learning of first grade children. Science Education, 1963, 47, 490-494.

A unit of three major concepts of science--time, change, and variety--was taught to a first-grade class whose mean score on the Science Research Associates Primary Mental Abilities Test was slightly lower than the average. Results as determined by teacher-made tests supported the hypothesis that average-ability first-grade children can learn scientific material in terms of basic concepts.

Weber, E., & Sunderlin, S. (Eds.) Primary Education: Changing Dimensions. Membership Service Bulletin 14-A. Association for Childhood Education, International, 1965.

Ten authors contributed chapters with the following titles: The Self--In Living and Learning, Transitions to First Grade, Challenging Children to Think, Achieving Multidimensional Learning, Differing Approaches to Beginning Reading, "New Mathematics" in the Primary Grade.

Weir, M. W. Developmental changes in problem-solving strategies. Psychological Review, 1964, 71, 473-490.

The performance of Ss at age levels from 3 years to 20 years in a problem-solving task was analyzed. Dependent variables include terminal level of correct response, rate of rise to terminal level of response, patterns of response, and performance as a function of a preceding correct or incorrect response. A U-shaped relationship between age and terminal level of correct response was reported, while age and simple patterns of response bear an inverted-U relationship to one another. Younger Ss show a more rapid rise to terminal level of response than do older Ss. In addition, differential effects of reinforcement and nonreinforcement are noted among the age groups, and differential changes occur in these effects as the task progresses. Differential growth of the ability to generate hypotheses and employ strategies and the ability to process the information Ss gain from their own responding is suggested to account for the major developmental differences reported.

Weir, M. W. Children's behavior in a two-choice task as a function of patterned reinforcement following forced-choice trials. Journal of Experimental Child Psychology, 1965, 2, 85-91.

One-hundred twenty children, after forced-choice trials acquainted them with the reinforcement schedules, were presented with a two-choice, partial reinforcement situation to test the hypothesis that they would prefer predictable to unpredictable schedules. Choices of one of the alternatives were reinforced on either a 50 per cent alternating or a 50 per cent random schedule, while choices of the other alternative were reinforced on either a 50, 60, or 70 per cent random reinforcement schedule. A significant preference for the predictable schedule was found, but only in groups for which both alternatives paid off with an equal percentage of reinforcement. The effects of a predictable schedule being apparently weak enough to be overcome by a discrepancy in percentage of reinforcement of 10 per cent, findings are related to theories of cognitive development stressing the importance of predictability, or congruity.

Weir, M. W., & Gruen, G. E. Role of incentive level, number of choices, and type of task in children's probability learning. Journal of Experimental Child Psychology, 1965, 2, 121-134.

Experiment included both two- and three-choice conditions in a probability-learning task in which children guessed which of two (or three) milk bottles contained a prize. High (trinkets and toys) and low (knowledge of results) incentive conditions were also included. Some support was provided for the previous finding that in this task incentives of high value produce more frequent choice of the high probability alternative than do incentives of lower value. Experiment two with a button-pressing task on three choices, provided evidence of marginal significance of an incentive effect in the opposite direction to that found in Experiment one. Large task differences were also found, with the milk bottle task resulting in fewer choices of the high probability alternative than did the button-pressing task.

Weir, M. W., & Stevenson, H. W. Effect of verbalization in children's learning as a function of chronological age. Child Development, 1959, 30, 173-178.

Children learn to discriminate among stimuli more rapidly if given pretraining in naming the stimuli or if they attach a verbal response to the stimuli during training. It is suggested that verbalization of stimulus names provides response-produced stimuli which increases differences among stimuli and aids learning by increasing the number of stimuli to which a discrimination response can become attached. The assumption that the facilitative effect decreases with increasing CA with older children supplying their own verbal labels was not supported. Instructions to verbalize facilitated learning at all age levels.

Wertheimer, M. *Productive thinking.* New York: Harper and Row, 1945.

New experiments by the author are summarized and analyzed from a Gestalt point of view. Concrete cases of thinking, particularly those of Galileo and Einstein, are presented as relatively closed systems.

White, S. H. Discrimination learning with everchanging positive and negative cues. *Journal of Experimental Child Psychology*, 1965, *2*, 154-162.

Eighty fourth and fifth graders were given a "double-variation" discrimination problem where both the positive and negative cues changed on every trial. Twenty children were not given pretraining, twenty were pretrained with a varying-positive condition, twenty with a varying-negative condition, and twenty with a simultaneous discrimination problem with constant positive and negative stimuli. Most of the Ss solved the double-variation problem with or without pretraining, and the various kinds of pretraining were of little help. It is suggested that double-variation learning is not explainable by processes conventionally used to describe learning but may be solved by a process in which models of seen cues are repeatedly stored, used as templates for interpretation of new cues, and revised.

Whitecraft, R. A., Cobb, H. V., & Davis, R. T. Supplementary Report: Solution of bentwire detour problems by preschool children. *Psychological Reports*, 1959, *5*, 609-611.

The performance of eighteen preschool children, aged 2, 3, and 5, was studied on bentwire detour problems. The performance of the 2-year-old children was comparable to that previously reported for adolescent apes and the performance of 3- and 5-year-old children was as high as or higher than that of adult apes.

Wilson, J. A. R. Long term effect of structured training on three young children. Paper presented at the meeting of the California Educational Research Association, Palo Alto, California, 1966.

> The long term effects of training in social and emotional learning with emphasis on reinforcement of desirable behavior and improvement of self-concept are reported for three maladjusted children. The children, who had been the subjects of an earlier study which employed intensive training, were found to retain some desirable behavior patterns as a result of the training, particularly when in similar situations; but the overriding effects of home and environment were noted.

Wilson, W. C. Imitation and the learning of incidental cues by preschool children. Child Development, 1958, 29, 393-397.

> The hypothesis "that the process of learning to perform an imitated response in an appropriate situation in the absence of the model is essentially that of learning of 'incidental' cues" was tested in a study using preschool children in a two-choice discrimination problem. The hypothesis was confirmed and results showed that learning was "more efficient using the imitation method than using the trial-and-error method."

Winer, G. A. An analysis of the role of set in the child's acquisition of number conservation. Paper presented at the meeting of the Eastern Psychological Association, New York, April, 1966.

> In a study to determine whether Smedslund's apparent success in inducing conservation of number with cognitive conflict situations can be explained by the Ss' acquisition of a set to respond to addition/subtraction or change in shape, kindergarten children were assigned to one of three training groups: addition/subtraction (A/S) set training, perceptual set training, or no training. The prediction that subjects who had A/S training would conserve was confirmed, but conservation behavior failed to generalize to an alternative test of conservation of number or to conservation of continuous quantity.

Wittrock, M. C., Keislar, E. R., & Stern, C. Verbal cues in concept identification. Journal of Educational Psychology, 1964, 4, 195-200.

> The study investigated problem solving and transfer produced by a single word or a single sentence spoken to kindergarten children while they were solving problems. The basis of predicting the

effects of these words or sentences was the hierarchy of associations taught them during about three months of preliminary training and testing before the experimental groups were formed. It was hypothesized and verified (.01 level) that a verbal cue for a class of problem produces greater transfer to new instances of the same class than do either more general or more specific cues. Apparatus which automatically presented sequences of pictures, sound, individual reinforcement, and recorded the data for 10 students simultaneously is described.

Wohlwill, J. F. A study of the development of the number concept by scalogram analysis. Journal of Genetic Psychology, 1960, 97, 345-377.

This study investigated the developmental process by which young children arrive at an abstract concept of number, using a matching-to-sample technique. Seventy-two subjects were tested ranging in age from 4 to 7 years. Scalogram analysis was used and results confirmed the theoretical views of Piaget's in demonstrating the existence of a relatively uniform developmental sequence in the formation of number concepts.

Wohlwill, J. F. Cognitive development and the learning of elementary concepts. Journal of Research in Science Training, 1964, 2, 222-226.

Longitudinal studies and a sequential analysis are seen as necessary to solve the mystery of cognitive development. It is suggested that, as a child develops, his perceptual set in approaching problems is supplemented by a different set which has more to do with symbolic operations relating to concepts. The development of this new set is discussed together with the role of measurement in the developmental process. Implications are drawn for providing general types of early experiences to facilitate cognitive development.

Wohlwill, J. F., & Lowe, R. C. An experimental analysis of the development of the conservation of number. Child Development, 1962, 33, 153-167.

Kindergarten children may learn that the number of elements in a set is conserved under changes in the arrangement of the elements, but such conservation responses mastered as empirical facts and show no transfer to a different situation in what the child's understanding of principle of conservation is assessed. Ss persisted in non-conservation responses even when made to count the two collections being compared to verify numerical identity empirically.

Wohlwill, J. F., & Wiener, M. Discrimination of form orientation in young children. *Child Development*, 1964, *35*, 1113-1125.

> A set of matching-to-sample trials, requiring the differentiation of an outline figure from its up-down or left-right reversal, was given to 24 subjects from 47 to 56 months. Ss showed a high level of proficiency in the task, indicating a well-developed ability to respond to stimulus orientation as a differentiating cue. Analysis of errors and latency data by type of stimulus figure gave some support to Ghent's downward scanning hypothesis, insofar as up-down reversals gave rise to fewer errors than left-right reversals; and strongly directional figures showed lower latencies than weakly directional ones.

Wright, J. C., & Kagan, J. (Eds.), Basic cognitive processes in children. *Monographs of the Society for Research in Child Development*, 1963, *28*, (2, Whole No. 86).

> A report of the Second Conference sponsored by the Committee on Intellectual Processes Research of the Social Science Research Council, the monograph includes articles on perception, mediating responses, discrimination learning, styles of conceptualization, the development of equivalence transformations, mathematical models, and Soviet research in Children's cognitive processes.

Yates, A. J. Speed and personality factors in the intellectual performance of young children. *British Journal of Educational Psychology*, 1966, *36*, 312-316.

> A group of 100 9-year-old pupils was given part of Progressive Matrices and an Arithmetic test with initial and final time limits. As in previous studies with university students, groups of Ss could be identified who were slow but accurate workers whose intellectual level was severely underestimated by imposed time limits. It was also shown that the same Ss tended to be handicapped by imposed time limits on both tests. No relationship between preferred work method and Neuroticism or Extraversion scores on the Junior MPI was found.

Youniss, J. Concept transfer as a function of shifts, age, and deafness. *Child Development*, 1964, *35*, 695-700.

> Hearing and deaf children, ages 7 and 13, were tested in three successive sorting tasks. On stage two, half the Ss performed intradimensional (IN) and the other half extradimensional (EX) shifts; and on stage three, half of both shift groups made another

IN or EX shift. Apparently IN were easier than EX shifts in both stages, except when EX shift was made to a previously relevant dimension. While shift differences were in agreement with mediating response principles, lack of reliable age and deafness effects suggested that minimal language experience was necessary for mediating response utilization in this task.

Youniss, J., & Furth, H. G. Attainment and transfer of logical connectives in children. *Journal of Educational Psychology*, 1964, *55*, 357-361.

Children--CA 10 through 13, classified by correction procedure instances of conjunction, exclusive disjunction, and conjunctive absence--responded by means of symbols which distinctly represented logical connectives and stimulus elements. Ss who had attained criterion were asked to identify new instances of these classes by means of the learned symbols. On the uncorrected transfer task with new instances the 2 older groups were clearly superior to the younger Ss. Apparently success on attainment could be achieved through rote, but only the older Ss learned at the same time that the symbols referred to logical connectives. Results support Piaget's distinction between concrete and formal operational developmental stages.

Zeiler, M. Solution of the two-stimulus transposition problem by four- and five-year-old children. *Journal of Experimental Psychology*, 1966, *71*, 576-579.

Sixty-four 4- and 5-year-old children were given a transposition test with stimulus pairs from 1 to 4 steps larger than the training set. Ss were trained and tested on pairs that either had an intrapair area factor of 1.4:1 or 1.96:1. All Ss were able to verbalize the relevant relationship. Ss with 1.96:1 sets learned the training discrimination faster than the other group and transposed in all tests. The 1.4:1 group revealed that increased difference between the training and test sets resulted in decreasing transposition. Data indicate that a determinant of the basis of solution of the transposition problem was the difficulty of the training discrimination. Uniform relational learning may be a function of the interaction of an easy discrimination with verbal processes.

Zhekulin, S. A. The development of intellectual operations in problem solving in school children. *Voprosy Psikhologii*, 1965, *2*, 79-90. (*Child Development Abstracts*, 1966, *40*, 21)

This study investigated the development of mental processes in 10- to 16-year-old school children. Three levels in problem solving were identified. At the first level school children solved problems without comprehension of a given function by sequential transition from subject or unit, forming a sequence, to another. At the second level school children comprehended a function only partially; at the third level, completely. The height of the level was expressed by the degree of rationality of employed algorhythms in problem solving or in the economy of necessary steps.

Zigler, E., & DeLabry, J. Concept switching in middle-class, lower-class and retarded children. Journal of Abnormal and Social Psychology, 1962, 65, 267-273.

This study tested performance on a concept-switching task under different reward conditions with middle-class, lower-class and retarded groups matched on mental age. Intangible and tangible rewards were used with each type of subject. Middle-class subjects were expected to perform effectively under the intangible rather than tangible-reward condition and the lower-class and retarded subjects more effectively under tangible reinforcement. It was further hypothesized that the middle-class group would perform better than the other two groups under intangible reinforcement, but that no differences would be found if the optimal reinforcement was used with each group. In general, the findings of the study supported the hypotheses. However, when the middle-class intangible group was compared with the retarded and the lower-class children under tangible reinforcement (defined as optimal reinforcement for each group), no differences in performance were found.

Zigler, E., & Unell, E. Concept-switching in normal and feebleminded children as a function of reinforcement. American Journal of Mental Deficiency, 1962, 66, 651-657.

Feebleminded and normal children matched for MA were given a concept-switching task with half of the Ss receiving an intangible reinforcer for correct solution to the problem and the other half receiving a tangible reinforcer. Both feebleminded and normals switched more readily under the tangible than under the intangible condition. Types of Ss showed no differences in performance.

Zimiles, H. A note on Piaget's concept of conservation. Child Development, 1963, 34, 691-695.

The suggestion that short training periods can be effective in changing a child's approach to conservation, made as a result of a study by Wohlwill and Lowe, is challenged; and an alternative interpretation is offered which is felt to be more consistent with the operations used in the Wohlwill and Lowe study.

Zinchenko, P. I. (Formation of method of logical memorization in first graders.) *Doklady Akademiya Pedagogicheskikh Nauk RSFSR*, 1959, *6*, 63-66, (*Psychological Abstracts*, 1961, *35*, P 387)

It appears that first graders cannot use classification spontaneously but that they can be taught to make use of classification. Classification and memorizing remain two separate acts of the learning process; first Ss have to classify, and then to learn. A complete subordination of classification to the learning process necessitates a higher development of mental abilities.

Zunich, M. Children's reaction to failure. *Journal of Genetic Psychology*, 1964, 104, 19-24.

This study attempted to (1) "observe the frequency of behavior responses which a child of preschool age gives when confronted with a failure situation, and (2) to compare these behavior responses with respect to sex and age of the child. Major findings were as follows: 1. Most of the children made an attempt to solve the problem alone. 2. Behavior responses such as emotional response, facial expression, and seeking information were observed most frequently. 3. Four-year-olds expressed more facial expressions and rationalizating behavior; while 3-year-olds expressed a significantly greater number of behaviors as no attempt, seeking help, and seeking information. 4. Boys showed more destructive emotional-response, facial-expression, rationalizing, and seeking-help behaviors; while girls showed such behaviors as attempting to solve alone, seeking contact, and seeking information."